ANNUAL REPORT

OF THE

MINISTER OF MINES

FOR THE

YEAR ENDED 31ST DECEMBER

1923

BEING AN ACCOUNT OF

MINING OPERATIONS FOR GOLD, COAL, ETC.

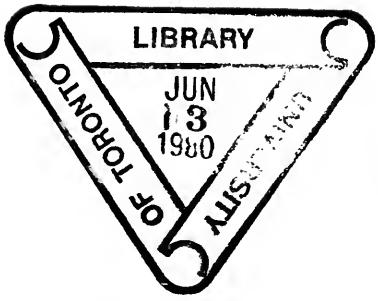
IN THE

PROVINCE OF BRITISH COLUMBIA.

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY

DEPARTMENT OF GEOLOGICAL SCIENCES,
UNIVERSITY OF TORONTO

VICTORIA, B.C.
Printed by Charles F. Banfield, Printer to the King's Most Excellent Majesty
1924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To His Honour WALTER CAMERON NICHOL,

Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The Annual Report of the Provincial Mineralogist upon the Mining Industry of the Province for the year 1923 is herewith respectfully submitted.

WILLIAM SLOAN,

Minister of Mines.

Minister of Mines' Office,

February 25th, 1924.

Middlesboro Colliery, Nicola Mining Division.

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To the Honourable William Sloan,

Minister of Mines.

SIR,—I have the honour to submit herewith my Annual Report on the Mining Industry of the Province for the year ended December 31st, 1923.

The statistical tables give the total mineral output of the Province to date, and show in considerable detail the actual mineral production of the past year, as based on smelter or mill returns; also a summary of the production of each of the last four years, thus illustrating by comparison the progress made in productive mining during this period.

To facilitate comparison with information previously given, I have retained, as closely as was possible, the general form already established for such tables and for the Report.

I have the honour to be,

Sir,

Your obedient servant,

WILLIAM FLEET ROBERTSON,

Provincial Mineralogist.

Bureau of Mines, Victoria, B.C.,

February 25th, 1924.

MINERAL PRODUCTION OF BRITISH COLUMBIA.

METHOD OF COMPUTING PRODUCTION.

In assembling the output of the lode mines in the following tables, the established custom of this Bureau has been adhered to, viz.: The output of a mine for the year is considered that amount of ore for which the smelter or mill returns have been received during the year. This system does not give the exact amount mined during the year, but rather the amount credited to the mine on the company's books during such year.

For ore shipped in December the smelter returns are not likely to be received until February in the new year, or later, and have, consequently, to be carried over to the credit of such new year. This plan, however, will be found very approximate for each year, and ultimately correct, as ore not credited in one year is credited in the next.

In the lode mines tables, the amount of the shipments has been obtained from certified returns received from the various mines, as provided for in the "Inspection of Metalliferous Mines Act." In calculating the value of the products, the average prices for the year in the New York Metal Market have been used as a basis. For silver 95 per cent., for lead 90 per cent., and for zinc 85 per cent. of such market prices have been taken. Treatment and other charges have not been deducted, except that in copper the amount of metal actually recovered has been taken, thus covering loss in slags.

TABLE I.—Total Production for all Years up to and including 1923.

Gold, placer	$ 76,962,203
Gold, lode	113,352,655
Silver	63,532,395
Copper	179,046,508
Lead	58,132,661
Zinc	27,904,756
Coal and coke	250,968,113
Building-stone, bricks, etc.	39,415,234
Miscellaneous minerals, etc.	1,408,257
Total	$810,722,782

TABLE II.—Production for each Year from 1852 to 1923 (inclusive).

1852 to 1895 (inclusive)	$ 94,547,241	1911	$ 23,499,072
1896	7,507,956	1912	32,440,800
1897	10,455,268	1913	30,296,398
1898	10,906,861	1914	26,388,825
1899	12,393,131	1915	29,447,508
1900	16,344,751	1916	42,290,462
1901	20,086,780	1917	57,010,392
1902	17,486,550	1918	41,782,474
1903	17,495,954	1919	33,296,313
1904	18,977,559	1920	35,543,084
1905	22,461,325	1921	28,066,641
1906	24,980,546	1922	35,158,843
1907	25,882,560	1923	41,304,320
1908	23,851,277		
1909	24,443,025	Total	$810,722,782
1910	26,377,066		

Table III. gives a statement in detail of the quantities and value of the different mineral products for the years 1921, 1922, and 1923. It is difficult to get absolutely complete statistics regarding building-stone, lime, bricks, tiles, and other miscellaneous products, but the detail figures shown in Table V. are as nearly accurate as can be obtained.

TABLE III.

QUANTITIES AND VALUE OF MINERAL PRODUCTS FOR 1921, 1922, AND 1923.

	Customary Measure.	1921.		1922.		1923.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold, placer	Ounces.	11,660	$ 233,200	18,240	$ 364,800	20,320	$ 420,000
" lode	"	135,663	2,804,154	197,856	4,089,684	179,245	3,704,994
Silver	"	2,673,389	1,591,201	7,101,311	4,554,781	6,032,986	3,718,129
Copper	Pounds	39,036,993	4,879,624	32,359,896	4,329,754	57,720,290	8,323,266
Lead	"	41,402,288	1,693,354	67,447,985	3,480,316	96,663,152	6,321,770
Zinc	"	49,419,372	1,952,065	57,146,548	2,777,322	58,343,462	3,278,903
Coal	Tons, 2,240 lb.	2,483,995	12,419,975	2,511,843	12,559,215	2,453,223	12,266,115
Coke	" "	59,434	416,038	45,835	320,845	58,919	412,433
Miscellaneous products			2,077,030		2,682,126		2,858,710
			$28,066,641		$35,158,843		$41,304,320

TABLE IV.

OUTPUT OF MINERAL PRODUCTS BY DISTRICTS AND DIVISIONS.

Names.	Divisions.			Districts.		
	1921.	1922.	1923.	1921.	1922.	1923.
No. 1 District				$ 7,323,662	$ 10,867,144	$ 10,369,235
Atlin, Stikine, and Liard	$ 148,546	$ 155,271	$ 157,874			
Nass River	4,784,945	4,561,185	5,240,085			
Portland Canal	1,530,083	5,288,469	4,121,213			
Skeena, Queen Charlotte, and Bella Coola	860,088	862,219	850,063			
No. 2 District				80,807	292,144	281,575
Cariboo and Quesnel	67,400	192,300	270,575			
Omineca and Peace River	13,407	99,844	11,000			
No. 3 District				959,095	1,421,850	555,131
Nicola and Vernon	936,865	1,383,143	405,603			
Yale, Ashcroft, and Kamloops	1,500	25,497	140,496			
Lillooet and Clinton	20,730	13,210	9,032			
No. 4 District				334,146	636,722	1,180,042
Grand Forks, Greenwood, and Osoyoos	334,146	635,722	437,657			
Similkameen		1,000	742,385			
No. 5 District				9,291,595	10,761,709	14,957,437
Fort Steele	7,626,214	8,871,647	12,915,722			
Windermere and Golden	26,763	59,406	102,092			
Ainsworth	121,760	90,954	174,900			
Slocan and Slocan City	181,011	1,358,635	1,526,194			
Nelson and Arrow Lake	76,862	65,925	27,035			
Trail Creek	1,250,233	272,967	189,439			
Revelstoke, Trout Lake, and Lardeau	8,752	42,775	22,055			
No. 6 District				10,077,336	11,179,274	13,960,900
Vancouver Island (Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria)	9,144,591	10,614,505	9,944,678			
Mainland (Vancouver and New Westminster)	932,745	564,769	4,016,222			
				$28,066,641	$35,158,843	$ 41,304,320

TABLE V.

Miscellaneous Products and Totals of Production, 1923.

District and Division.	Cement.	Lime and Limestone.	Building stone.	Riprap.	Crushed Rock, Flux.	Sand and Gravel.	Pottery and Clay.	Fire, Face, and Red brick.	Total Building Materials.	Miscellaneous Minerals.	Total Miscellaneous Products.	Total Output of Collieries.	Total Metalliferous Minerals.	Totals for Divisions.	Totals for Districts.
	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
No. 1 District															10,369,235
Atlin, Stikine, and Liard													157,874	157,874	
Nass River					47,000				47,000		47,000		5,193,085	5,240,085	
Portland Canal													4,121,243	4,121,243	
Skeena, Queen Charlotte, and Bella Coola				17,250		142,973			160,223		160,223		689,840	850,063	
No. 2 District															281,575
Cariboo and Quesnel													270,575	270,575	
Omineca and Peace River												2,000	9,000	11,000	
No. 3 District															555,131
Nicola and Vernon			600					5,831	6,431		6,431	399,080	92	405,603	
Yale, Ashcroft, and Kamloops								2,960	2,960		2,960	500	137,036	140,496	
Lillooet and Clinton										1,032	1,032		8,000	9,032	
No. 4 District															1,180,042
Grand Forks, Greenwood, and Osoyoos		14,410							14,410	11,782	26,192		381,465	407,657	
Similkameen												737,885	5,000	742,885	
No. 5 District															14,557,437
Fort Steele												3,666,208	9,249,454	12,915,662	
Windermere and Golden													102,002	102,002	
Ainsworth													174,000	174,000	
Slocan and Slocan City													1,526,194	1,526,194	
Nelson and Arrow Lake		20				2,500			2,520		2,520		24,515	27,035	
Trail Creek													180,439	180,439	
Revelstoke, Trout Lake, and Lardeau				3,500		17,555			21,055		21,055		1,000	22,055	
No. 6 District															13,900,500
Vancouver Island (Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria)	1,161,967	462,200	106,760	4,787	5,422	57,892	12,558	80,969	1,892,731	5,708	1,892,999	7,873,315	103,954	9,914,078	
Mainland (Vancouver and New Westminster)		2,881	700	34,708	98,650	168,146	104,979	244,776	654,632	1,326	655,958		3,353,774	4,010,732	
Totals	1,161,967	480,511	108,110	59,845	151,072	396,413	117,221	344,456	2,809,595	19,848	2,829,443	12,678,948	26,676,002	41,504,393	41,504,393

TABLE VI.—PLACER GOLD.

Table VI. contains the yearly production of placer gold to date, as determined by the returns sent in by the banks and express companies, of gold transmitted by them to the mints, and from returns sent in by the Gold Commissioners and Mining Recorders. To these yearly amounts one-third was added up to the year 1878; from then to 1895 and from 1898 to 1909, one-fifth; and since then one-tenth, which proportions are considered to represent, approximately, the amount of gold sold of which there is no record. This placer gold contains from 10 to 25 per cent. silver, but the silver value has not been separated from the totals, as it would be insignificant.

YIELD OF PLACER GOLD TO DATE.

1858	$ 705,000	1875	$ 2,474,004	1892	399,526	1909	$ 477,000
1859	1,615,070	1876	1,786,648	1893	356,131	1910	540,000
1860	2,228,543	1877	1,608,182	1894	405,516	1911	426,000
1861	2,666,118	1878	1,275,204	1895	481,683	1912	555,500
1862	2,656,903	1879	1,290,058	1896	544,026	1913	510,000
1863	3,913,563	1880	1,013,827	1897	513,520	1914	565,000
1864	3,735,850	1881	1,046,737	1898	643,346	1915	770,000
1865	3,491,205	1882	954,085	1899	1,344,900	1916	580,500
1866	2,662,106	1883	794,252	1900	1,278,724	1917	496,000
1867	2,480,868	1884	736,165	1901	970,100	1918	320,000
1868	3,372,972	1885	713,738	1902	1,073,140	1919	286,500
1869	1,774,978	1886	903,651	1903	1,060,420	1920	221,600
1870	1,336,956	1887	693,709	1904	1,115,300	1921	233,200
1871	1,799,440	1888	616,731	1905	969,300	1922	364,800
1872	1,610,972	1889	588,923	1906	948,400	1923	420,000
1873	1,305,749	1890	490,435	1907	828,000		
1874	1,844,618	1891	429,811	1908	647,000		
						Total	$76,962,203

TABLE VII.—PRODUCTION OF LODE MINES.

YEAR.	GOLD.		SILVER.		COPPER.		LEAD.		ZINC.		TOTAL VALUE.
	Oz.	Value.	Oz.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	
		$		$		$		$		$	$
1887			17,690	17,331			204,800	9,216			26,547
1888			79,780	75,000			674,500	29,813			104,813
1889			53,192	47,873			165,100	6,498			54,371
1890			70,427	73,948			*Nil.*	*Nil.*			73,948
1891			4,500	4,000			*Nil.*	*Nil.*			4,000
1892			77,160	66,935			808,420	33,064			99,999
1893	1,170	23,404	227,000	195,000			2,135,023	78,996			297,400
1894	6,252	125,044	746,379	470,219	324,680	16,234	5,662,523	169,875			781,342
1895	30,264	785,271	1,496,522	977,229	952,840	47,642	16,475,464	532,255			2,342,397
1896	62,259	1,244,180	3,135,343	2,100,689	3,818,556	190,926	24,199,977	721,384			4,257,179
1897	106,141	2,122,820	5,472,971	3,272,836	5,325,180	266,258	38,841,135	1,390,517			7,052,431
1898	110,061	2,201,217	4,292,401	2,375,841	7,271,678	874,781	31,693,559	1,077,581			6,529,420
1899	138,315	2,857,573	2,939,413	1,663,708	7,722,591	1,351,453	21,862,436	878,870			6,751,604
1900	167,152	3,453,381	3,958,175	2,309,200	9,997,080	1,615,289	63,358,621	2,691,887			10,069,757
1901	210,384	4,348,603	5,151,333	2,884,745	27,603,746	4,446,963	51,582,906	2,002,733			13,683,044
1902	236,491	4,888,269	3,917,917	1,941,328	29,636,657	3,446,673	22,536,381	824,832			11,101,102
1903	232,821	4,812,616	2,996,204	1,521,472	34,359,921	4,547,535	18,089,283	689,744			11,571,367
1904	222,042	4,589,608	3,222,481	1,719,516	35,710,128	4,578,037	36,646,244	1,421,874			12,309,035
1905	238,660	4,933,102	3,439,417	1,971,818	37,692,251	5,876,222	56,580,703	2,399,022			15,180,164
1906	224,027	4,630,639	2,990,262	1,897,320	42,990,488	8,288,565	52,408,217	2,667,578			17,484,102
1907	196,179	4,055,020	2,745,448	1,703,825	40,832,720	8,166,544	47,738,703	2,291,458			16,216,847
1908	255,582	5,282,880	2,631,389	1,321,483	47,274,614	6,240,249	43,195,733	1,632,799			14,477,411
1909	238,224	4,924,060	2,532,742	1,239,270	45,597,245	5,918,522	44,396,346	1,709,259	8,500,000	400,000	14,191,141
1910	267,701	5,533,360	2,450,241	1,245,016	38,243,934	4,871,512	34,658,746	1,386,350	4,184,192	192,473	13,228,731
1911	228,617	4,725,513	1,892,364	958,293	36,927,656	4,571,644	26,872,397	1,069,521	2,634,544	129,092	11,454,063
1912	257,496	5,322,442	3,132,108	1,810,015	51,456,537	8,408,513	44,871,454	1,805,627	5,358,280	316,139	17,662,766
1913	272,254	5,627,490	3,465,856	1,968,606	46,460,305	7,094,489	55,364,677	2,175,232	6,758,768	324,421	17,190,838
1914	247,170	5,109,004	3,602,180	1,876,736	45,009,699	6,121,319	50,625,048	1,771,877	7,866,467	346,125	15,225,061
1915	250,021	5,167,934	3,366,506	1,588,991	56,918,405	9,835,500	46,503,590	1,939,200	12,982,440	1,460,524	19,992,149
1916	221,932	4,587,334	3,301,923	2,059,739	65,379,364	17,784,494	48,727,516	3,007,462	37,168,980	4,043,985	31,483,014
1917	114,523	2,367,190	2,929,216	2,265,749	59,007,565	16,038,256	37,307,465	2,951,020	41,848,513	3,166,259	26,788,474
1918	161,674	3,403,812	3,198,172	3,215,870	61,483,754	15,143,449	43,899,661	2,928,107	41,772,916	2,899,040	27,590,278
1919	152,426	3,150,645	3,403,119	3,592,673	42,459,339	7,939,896	29,475,968	1,526,855	56,737,651	3,540,429	19,750,498
1920	120,048	2,481,392	3,377,849	3,235,980	44,887,676	7,832,899	39,331,218	2,816,115	47,208,268	3,077,979	19,444,365
1921	135,662	2,804,154	2,673,389	1,591,201	39,036,993	4,879,624	41,402,288	1,693,354	49,419,372	1,952,065	12,920,398
1922	197,856	4,089,684	7,101,511	4,554,781	32,359,896	4,329,754	67,447,985	3,480,316	57,146,548	2,777,322	19,231,857
1923	179,245	3,704,904	6,022,986	3,718,129	57,720,290	8,323,266	96,663,152	6,321,770	58,343,462	3,278,903	25,347,062
Total	5,404,652	113,352,655	102,425,366	63,532,395	1 054 460 188	179,046,508	1,242,407,239	58,132,661	437,930,401	27,904,756	441,968,975

TABLE VIII.—COAL AND COKE PRODUCTION PER YEAR TO DATE.

COAL.

Year.	Tons (2,240 lb.)	Value
1836-1885	3,029,011	$ 9,468,557
1886	326,636	979,908
1887	413,399	1,240,080
1888	489,301	1,467,903
1889	579,830	1,739,490
1890	678,140	2,034,420
1891	1,029,667	3,087,291
1892	826,335	2,479,005
1893	978,294	2,934,882
1894	1,012,953	3,038,859
1895	939,654	2,818,962
1896	896,222	2,688,666
1897	882,854	2,648,562
1898	1,135,865	3,407,595
1899	1,306,324	3,918,972
1900	1,439,595	4,318,785
1901	1,460,331	4,380,993
1902	1,397,394	4,192,182
1903	1,168,194	3,504,582
1904	1,253,628	3,760,884
1905	1,384,312	4,152,936
1906	1,517,303	4,551,909
1907	1,800,067	6,300,235
1908	1,677,849	5,872,472
1909	2,066,476	7,022,996
1910	2,800,046	9,800,161
1911	2,193,062	7,675,717
1912	2,628,804	9,200,814
1913	2,137,483	7,481,190
1914	1,810,967	6,338,385
1915	1,611,129	5,638,952
1916	2,084,093	7,294,325
1917	2,149,975	7,524,913
1918	2,302,245	11,511,225
1919	2,267,541	11,337,705
1920	2,595,125	12,975,625
1921	2,483,995	12,419,975
1922	2,511,843	12,559,215
1923	2,453,223	12,266,115
Total	61,658,556	$226,035,113

COKE.

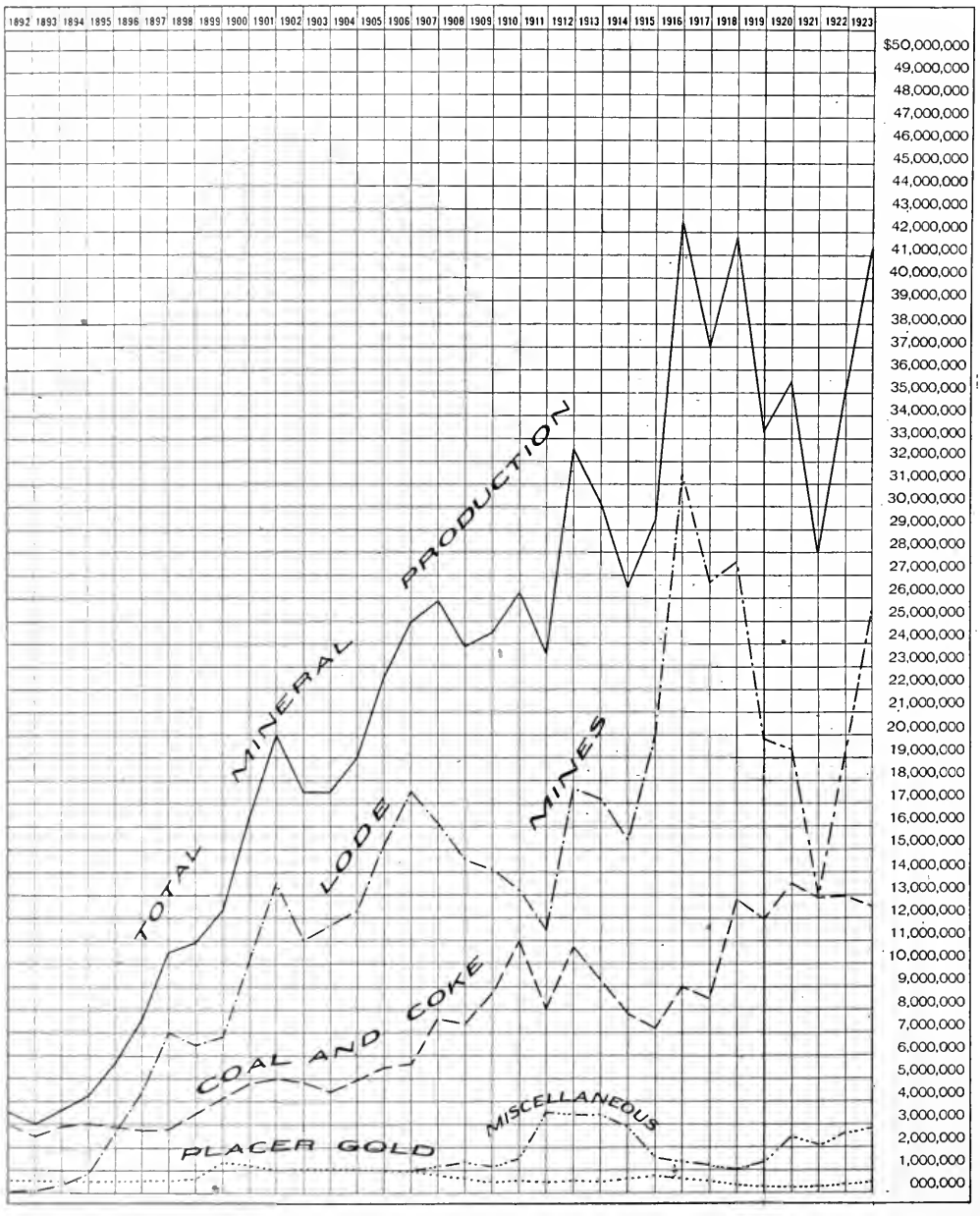
Year.	Tons (2,240 lb.)	Value
1895-97	19,396	$ 96,980
1898 (estimated)	35,000	175,000
1899	34,251	171,255
1900	85,149	425,745
1901	127,081	635,405
1902	128,015	640,075
1903	165,543	827,715
1904	238,428	1,192,140
1905	271,785	1,358,925
1906	199,227	996,135
1907	222,913	1,337,478
1908	247,399	1,484,394
1909	258,703	1,552,218
1910	218,029	1,308,174
1911	66,035	396,030
1912	264,333	1,585,998
1913	286,045	1,716,270
1914	234,577	1,407,462
1915	245,871	1,475,226
1916	267,725	1,606,350
1917	159,905	959,430
1918	188,967	1,322,769
1919	91,138	637,966
1920	67,792	474,544
1921	59,434	416,038
1922	45,835	320,845
1923	58,919	412,433
Total	4,287,455	$24,933,000

TABLE IX.—PRODUCTION IN DETAIL OF THE

DISTRICT.	YEAR	TONS.	GOLD—PLACER.		GOLD—LODE.		SILVER.	
			Ounces	Value.	Ounces.	Value.	Ounces.	Value.
				$		$		$
North-western District (No. 1)								
Atlin, Stikine, and Liard Divisions	1920		6,930	138,600				
	1921	55	7,210	144,200	3	62	1,808	1,076
	1922	60	7,450	149,000	3	62	4,109	2,635
	1923	12	7,570	156.500	1	21	1.008	621
Nass River Division	1920	834,176			8,094	167,304	1,219,128	1,167,924
	1921	907,964			8,595	177,659	365,240	217,390
	1922	857,373			9,125	188,614	399,481	256,227
	1923	833.478			8.077	166.951	444.610	274.038
Portland Canal Division	1920	800			2,283	47,189	77,350	74,102
	1921	18,750			40,104	828,949	1,177,978	701,133
	1922	102,343			123,527	2,553,303	4,264,228	2,735.076
	1923	145.665			117.293	2.424.446	2,746.551	1,692,700
Skeena, Queen Charlotte, and Bella Coola Divisions	1920	109,232	150	3,000	44,154	912,663	21 354	20,457
	1921	134,574	100	2,000	36,483	754,103	20,781	12,369
	1922	105,982			35,081	725,124	17,126	10,985
	1923	88.300			29.660	613.072	17.515	10.794
North-eastern District (No. 2)								
Cariboo and Quesnel Divisions	1920		3,300	66,000				
	1921		3,370	67,400				
	1922		9,615	192,300				
	1923	268	11.128	230.000	42	868	51.410	31.684
Omineca and Peace River Divisions	1920	4,000	150	3,000	218	4,506	103,020	98,693
	1921	71	150	3,000	13	269	3,745	2,229
	1922	905	275	5,500	66	1,364	20,274	13,004
	1923		435	9.000				
Central District (No. 3)								
Nicola and Vernon Divisions	1920	62			14	289	1,545	1,480
	1921							
	1922	291	175	3,500	433	8,950	169	108
	1923	2			2	41	82	51
Yale, Ashcroft, and Kamloops Divisions	1920	1,025	50	1,000	238	4,919	437	419
	1921		50	1,000				
	1922	72	150	3,000	364	7,524	39	25
	1923	2.952	145	3.000	562	11.616	1.382	858
Lillooet and Clinton Divisions	1920	200	175	3,500	120	2,480		
	1921	500	400	8,000	374	7,730		
	1922	1,588	275	5,500	373	7,710		
	1923		387	8.000				
Southern District (No. 4.)								
Grand Forks, Greenwood, and Osoyoos Divisions	1920	84,125	25	500	20,366	420,965	385,681	369,482
	1921	41,658	25	500	735	15,192	160,051	95,262
	1922	46,274	225	500	17,918	370,365	211,730	135,804
	1923	45.019	240	5.000	10.934	226.006	227.047	139.929
Similkameen Division	1920	18,934	25	500	69	1,427	3,331	3,191
	1921		50	1,000				
	1922		50	1,000				
	1923		240	5.000				
Eastern District (No. 5)								
Fort Steele Division	1920	267,381	175	3,500			362,143	346,933
	1921	208,516	150	3,000	1	20	546,631	325,355
	1922	360,845	150	3,000			956,028	613,196
	1923	489.876	100	2.000			1,176.683	725,190
Windermere and Golden Divisions	1920	1,977					53,510	51,263
	1921	440					18,508	11,016
	1922	862					27,004	17,320
	1923	1.33					46.340	28.559
Ainsworth Division	1920	18,213			32	661	266,963	255,751
	1921	5,523			11	227	115,772	68,907
	1922	5,265			25	517	53,736	34,466
	1923	12.980			15	310	91.478	56.378
Slocan and Slocan City Divisions	1920	59,768			73	1,509	738,515	707,497
	1921	5,692			19	393	188,142	111.982
	1922	46,454			224	4,630	1,104,628	708,508
	1923	62 245			361	7.463	1.036.582	669.660
Nelson and Arrow Lake Divisions	1920	6,189	25	500	1,924	39,769	7,065	6,768
	1921	11,048	50	1,000	3,587	74,143	2,130	1,268
	1922	5,917			2,392	49,443	7,232	4,639
	1923	523			319	6.594	6.242	3.847
Trail Creek Division	1920	67,714			36,425	752,905	36,411	34,882
	1921	89,107			44,980	929,737	60,184	35,822
	1922	18,982			8,256	170,651	16,638	10,672
	1923	18.568			6.983	144.334	9.701	5.979
Revelstoke, Trout Lake, and Lardeau Divisions	1920	91	50	1,000	7	145	7,979	7,644
	1921	31	50	1,000	8	165	3,871	2,304
	1922	73	50	1,000	4	83	4,521	2,900
	1923		50	1.000				
South-western District (No. 6)								
Vancouver Island (Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria Divisions)	1920	6,183	25	500	19	393	2,745	2,630
	1921	1,331	25	500	104	2,150	605	360
	1922	19,900	25	500	65	1,344	14,368	9,216
	1923	33.104	25	500	120	2.480	17.341	10.687
Mainland (Vancouver and New Westminster Divisions)	1920	698,117			6,012	124,268	90,672	86,864
	1921	47,385			646	13,355	7,943	4,728
	1922							
	1923	682.511			4.876	100.787	103.964	67.154
TOTALS	1920	2,178,187	11,080	221,600	120,048	2,481,392	3,377,849	3,235,980
	1921	1,562,645	11,660	233,200	135,663	2,804,154	2,673,389	1,591,201
	1922	1,573,186	18,240	364,800	197,856	4,089,684	7,101,311	4,554,781
	1923	2.421.831	20.320	420.000	179.245	3.704.994	6.032.986	3.718.129

METALLIFEROUS MINES, ETC., FOR 1920, 1921, 1922, AND 1923.

COPPER.		LEAD.		ZINC.		TOTALS FOR DIVISIONS				TOTALS FOR DISTRICTS
Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	1920.	1921.	1922.	1923.	1923.
	$		$		$	$	$	$	$	$
										10,161,982
						135,000				
25,604	3,208						148,646			
21,603	2,963	13,000	671					155,271		
188	27	10,782	706						157,874	
25,404,950	4,433,162					5,788,200				
34,067,185	4,258,398						4,953,417			
30,334,584	4,058,767	1,295	50					4,743,674		
32,960,826	4,751,509	8,513	557						5,193,066	
						121,291				
							1,520,162			
675	90							5,288,402		
		62,191	4,057						4,121,213	
748,450	130,606					1,066,720				
748,018	93,615						862,087			
697,058	93,260							829,375		
457,522	65,974								389,840	
										279,575
						66,000				
							67,400			
								102,200		
		122,680	8,023						270,575	
		149,488	13,967	453,512	29,569	149,335				
28,000	3,250	4,930	392	11,561	657		9,407			
2,800	375	30,970	1,860	21,071	1,024			22,800		
									9,000	
										145,128
		2,720	195			1,964				
								12,558		
									52	
200,808	45,511					51,849				
							1,000			
213	28							10,577		
843,011	121,562								137,030	
						5,000				
							17,700			
								13,210		
									8,000	
										336,465
582,300	101,622	100,433	7,020			900,180				
432,505	54,063	51,208	2,097				167,114			
		144,251	7,443					514,112		
		161,008	10,530						311,495	
463,347	80,855					85,073				
							1,000			
								1,000		
									5,000	
										11,207,284
		26,926,319	1,927,924	62,881,092	2,705,847	5,074,294				
		38,496,820	1,566,903	69,319,198	1,948,108		3,834,016			
		57,743,931	2,979,567	51,672,816	2,511,299			6,107,062		
		85,676,187	5,603,222	51,940,253	2,919,042				9,249,454	
1,953	341	1,095,486	78,437			130,041				
		385,000	15,747				96,763			
		815,618	42,086					59,096		
		1,124,370	73,533						102,022	
		4,072,807	291,013	158,193	10,314	558,339				
		1,294,845	61,732	22,629	894		121,700			
		839,681	42,057	273,949	13,314			80,964		
638	92	1,673,847	109,470	153,904	8,650	1,388,563			174,500	
		6,135,581	439,508	3,715,471	242,249		181,011			
		1,614,425	66,039	65,084	2,990			1,308,035		
		7,633,624	391,895	5,164,661	251,092				1,523,134	
		7,612,544	497,810	6,249,306	351,211	98,065				
755	172	719,219	51,691				76,861			
3,183	806	1,301	52					63,919		
252	34	176,747	9,129	14,051	683				24,215	
		210,620	13,774			992,020				
1,113,085	194,233						1,270,253			
2,277,302	284,674							772,967		
694,930	91,644								198,433	
271,001	39,092	410	29			14,744				
		83,195	5,955				4,030			
		13,000	561					3,175		
		61,869	3,193						1,000	
										3,526,619
						22,850				
110,000	19,316						8,000			
46,770	5,506							93,707		
617,001	82,647								143,304	
1,033,121	149,697					3,058,253				
16,201,270	2,457,121						194,305			
1,411,376	176,422									
									3,313,284	
22,158,893	3,196,313									
64,867,676	7,832,809	39,381,218	2,816,115	47,208,704	3,077,979	13,893,993				
39,036,993	4,679,624	41,402,288	1,993,354	69,419,977	1,972,005		13,153,309			
32,319,900	4,129,784	67,447,995	3,493,316	57,146,344	2,727,372			13,206,407		
57,720,200	8,323,205	96,663,152	6,321,770	58,343,902	3,276,101				25,717,078	25,717,078


1892 1893 1894 1895 1896 1897 1898 1899 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923
$50,000,000
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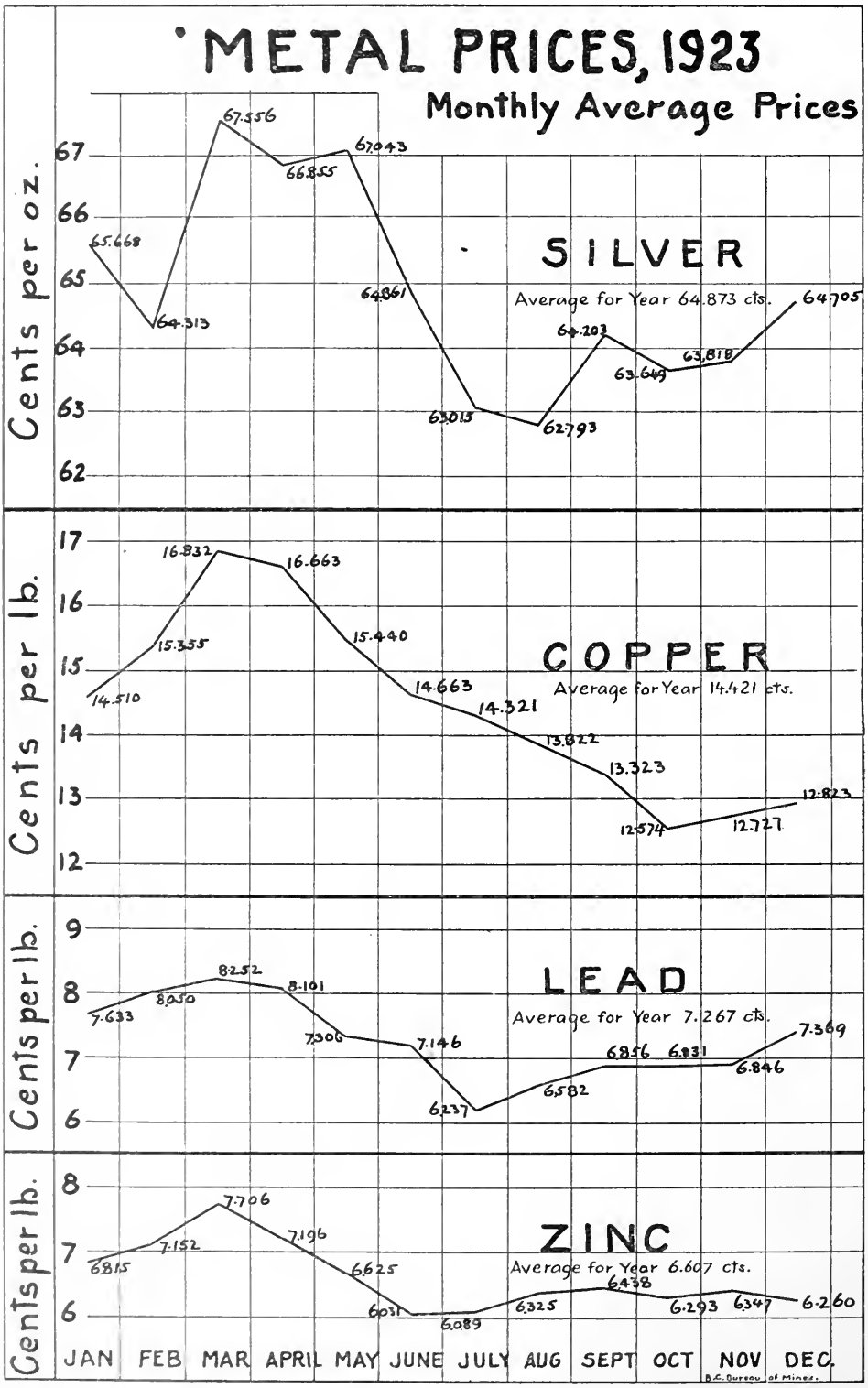
TOTAL MINERAL PRODUCTION
LODE MINES
COAL AND COKE
PLACER GOLD
MISCELLANEOUS

Price of Metals
Jan. 1913 to Dec. 1923
Silver
Copper
Zinc
Lead
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923


METAL PRICES, 1923
Monthly Average Prices
Cents per oz.
67
66
65
64
63
62
65.668
64.313
67.556
66.855
67.043
64.861
63.013
62.793
64.203
63.649
63.818
64.705
SILVER
Average for Year 64.873 cts.
Cents per lb.
17
16
15
14
13
12
14.510
15.355
16.832
16.663
15.440
14.663
14.321
13.822
13.323
12.574
12.727
12.823
COPPER
Average for Year 14.421 cts.
Cents per lb.
9
8
7
6
7.633
8.050
8.252
8.101
7.306
7.146
6.237
6.582
6.856
6.831
6.846
7.369
LEAD
Average for Year 7.267 cts.
Cents per lb.
8
7
6
6.815
7.152
7.706
7.196
6.625
6.031
6.089
6.325
6.438
6.293
6.347
6.260
ZINC
Average for Year 6.607 cts.
JAN FEB MAR APRIL MAY JUNE JULY AUG SEPT OCT NOV DEC.
B.C. Bureau of Mines.

PROGRESS OF MINING.

The gross value of the mineral production of the Province for the year 1923 was $41,204,320, an increase from that of the preceding year of $6,145,477, or equivalent to an increase of about 17.5 per cent.

It is extremely gratifying to note that the above-mentioned output for the year 1923 has only been exceeded twice in the history of mining in the Province, and that was in 1916, when production reached $42,200,162, and in 1918, when the figure of $41,782,474 was attained. In these two years the production was the result of the war-time stimulus of output and war-time prices of the metals.

In the face of the explanation of the causes of these higher years, the output of 1923 is very creditable and indicates that normal conditions are returning, and may be expected to remain.

As noted in last year's Report, and equally true as yet, Europe is the world's metal market, to which practically all export metals find their way. As Europe is the consumer, the industrial conditions of Europe regulate the consumption of and demand for the metals.

That Europe is still in a decidedly unsettled condition at the present time cannot be questioned, but, for all that, the consumption of the metals does seem to have increased, and the greatly overstocked metal market on this continent, which accounted for the tremendous drop in the metal prices in 1921, have been somewhat relieved, with the result that metal prices in 1923 have been materially higher than in 1920, 1921, or 1922.

To illustrate what this increase has been during the past year, the following table shows the average market prices of the various metals for the years 1922 and 1923:—

AVERAGE METAL-MARKET PRICES FOR YEARS 1922 AND 1923.

	Silver	Copper	Lead	Zinc
	Cents	Cents	Cents	Cents
1922	67 52	13 38	5 73	5 72
1923	64 87	14 42	7 27	6 61
Percentage increase in 1923	*3 92	7 77	26 87	15 57

* Decrease.

To indicate how fluctuating the market has been, charts have been prepared to accompany this Report (pages 15 and 16) which show the monthly fluctuations of metal market prices from 1913 to date.

It is quite apparent from the charts that there has been a great drop from war-days in all metal prices, but, for all this, it is to be noted that the market prices even at the end of the year 1923 are not lower than the normal pre-war prices, at which profitable mining was carried on under pre-war conditions.

During the year 1922, as shown in table, page 16 of that Report, the market prices steadily increased, and were still increasing during the earlier part of the year 1923, when a slight fall took place, but remain at a point where a margin of profit for the miner is visible.

During the past two years the costs of mining, including wages and supplies, have been materially decreased, so that the outlook for the next year's mining is brighter, and a reasonable margin of profit seems to be assured to the producers.

During 1921 all the large copper-producers of this continent, by concerted action, reduced their output to about 25 per cent. of normal, or shut down entirely, so as to reduce the stocks

of copper on hand; the effect of this movement has now become apparent in the disappearance of the surplus stocks of the metals and the revival of a demand market at a living price.

We now hear that some of these companies have prepared and others are preparing to start up again, which is a sign tending to optimism for the future of the copper market, which reached 14 cents during the last month of 1922, and during the year 1923 very nearly approached 14.5 cents.

During the copper market depression the larger companies got busy in a propaganda for a more extended use of copper, which has been successful in creating a new and increased domestic market for the metal, particularly in the United States, for builders' use, roofs, etc. Some of our large producers, spurred on by sheer necessity, made economies they had not recognized as possible, and are now assured a more profitable future with the return to more normal conditions.

The copper-output for 1923 was 57,720,290 lb., valued at $8,323,266, an increase over last year's output of 25,360,394 lb., or about 80 per cent., but still below the normal output of the Province.

During most of the year 1921 there was no demand for lead or zinc, and a great amount of such metals in the refined state accumulated at the Trail smelter to an extent that prohibited the further purchase of such ore by the custom smelters, which cause absolutely shut down many of the Slocan mines.

During the latter part of the year 1922 the Trail smelter was fortunate in finding an outlet in the Orient for the greater part of its accumulated lead and zinc stocks on hand, which again permitted prompt cash payment for ores of these metals to be made, and thus again started up these mines in the Slocan, so that the year 1923 has seen these properties working again on a normal basis.

In 1923 the output of lead was 96,663,152 lb., having a value of $6,321,770, an increase of 29,215,167 lb., or 43 per cent. over 1922, chiefly due to the increased output of the *Sullivan* mine and to the renewed activity of Slocan District mines, due to the fact that the Trail smelter was again able to receive customs lead ores.

The production of zinc in 1923 was 58,343,462 lb., valued at $3,278,903, an increase over the preceding year, amounting to 1,196,914 lb., or about 3 per cent. The greater amount of this was mined at the *Sullivan* mine in East Kootenay and refined at Trail.

The collieries of British Columbia in 1923 almost held their own, having made a net coal production of 2,453,223 tons (2,240 lb.), slightly less than in 1922.

With the exception of three years, the net coal-output for 1923 is larger than any other year since 1912.

There was 58,919 tons of coke produced in the Crowsnest District. The Anyox smelter converted some coal into coke for their own use.

The aggregate of the values of British Columbia colliery products in 1923 was $12,678,548, this being less than the gross value of this year's metalliferous products of $25,767,062.

It is noteworthy that the North-western District produced 44 per cent. of the tonnage of ore mined in British Columbia in 1923, carrying about 39 per cent. of the total value of the metalliferous output of the Province.

The following table shows the number of mines which shipped ore during the year 1923, the districts in which they are situated, and the tonnage produced in each district, together with the number of men employed, both above ground and underground.

In explanation of the table it should be said that, in its preparation, a mine employing twelve men for four months is credited in the table with four men for twelve months, so that the total given is less than the actual number of individuals who worked in the mines during the year.

TABLE SHOWING DISTRIBUTION OF SHIPPING MINES IN 1923.

	Tons of Ore shipped.	No. of Mines shipping.	No. of Mines shipping over 100 Tons in 1923.	Men employed in these Mines.		
				Below.	Above.	Total.
No. 1 District.						
Atlin, Stikine, and Liard	12	1	..	2	4	6
Nass River	838,478	3	2	215	102	317
Portland Canal	145,665	1	1	181	155	336
Skeena, Queen Charlotte, and Bella Coola	88,300	1	1	135	75	210
No. 2 District.						
Cariboo and Quesnel	..	..	..	..	..	..
Omineca and Peace River	268	1	1	32	46	78
No. 3 District.						
Nicola and Vernon	2	..	..	..	..	..
Yale, Ashcroft, and Kamloops	2,952	1	1	20	18	38
Lillooet and Clinton	..	..	..	..	..	..
No. 4 District.						
Grand Forks, Greenwood, and Osoyoos	45,019	12	3	124	75	199
Similkameen	..	..	..	..	..	..
No. 5 District.						
Fort Steele	489,876	4	1	250	240	490
Windermere and Golden	1,336	4	2	23	10	33
Ainsworth	13,052	13	3	60	36	96
Slocan and Slocan City	62,245	31	7	191	125	316
Nelson and Arrow Lake	451	3	2	14	4	18
Trail Creek	18,568	3	2	226	114	340
Revelstoke, Trout Lake, and Lardeau	..	..	..	..	..	..
No. 6 District.						
Vancouver Island (Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria)	33,104	1	1	44	21	65
Mainland (Vancouver and New Westminster)	682,511	1	1	453	378	831
Totals	2,421,839	77	28	1,970	1,403	3,373

In the following table of the non-shipping mines the returns are necessarily incomplete, as they include only the mines reporting to the Department, and not the prospects and properties under preliminary development, which in the aggregate give employment to a large number of men.

TABLE SHOWING NON-SHIPPING MINES AND MEN EMPLOYED IN 1923.

District.	Number of Mines.			Men employed.		
	Working.	Idle.	Total.	Below.	Above.	Total.
No. 1. North-western Mineral Survey District	4	3	7	22	29	51
No. 2. North-eastern Mineral Survey District	3	3	6	23	36	59
No. 3. Central Mineral Survey District	5	7	12	18	18	36
No. 4. Southern Mineral Survey District	3	14	17	8	1	9
No. 5. Eastern Mineral Survey District	19	53	72	45	19	64
No. 6. Western Mineral Survey District	1	5	6	16	10	26
Totals	35	85	120	132	113	245

SUMMARY OF STATISTICAL TABLES.

Referring to the preceding tables of the mineral production of the Province, the following is a summary of their contents:—

TABLE I. shows the total gross value of each mineral product mined in the Province up to the end of 1923, aggregating $810,722,782. From this table it will be seen that coal-mining has produced more than any other separate class of mining, a total of $250,968,113; followed next in importance by copper at $179,046,508, and next in order is lode gold at $113,352,655, with placer gold in fourth place at $76,962,203.

TABLE II. shows the value of the total production of the mines of the Province from 1852 to 1895 (inclusive) and for each year from 1896 to 1923 (inclusive), during which period the output increased tenfold, and had a gross production for the year 1923 of $41,304,320.

The value of the total mineral production of the Province up to the end of 1923 was $810,722,782.

TABLE III. gives the quantities in the customary units of measure, and the values, of the various metals or minerals which go to make up the total of the mineral production of the Province, and also, for the purpose of comparison, similar data for the two preceding years.

The table shows that there has been this year an increase in the production of placer gold of $55,200 and a decrease in output of lode gold of $384,690, making a decrease of $325,490 in the total production of the precious metal.

The amount of silver produced this past year was 6,032,986 oz., having a gross value of $3,718,129, a decrease in the number of ounces produced of 1,068,325.

The table shows an output of lead amounting to 96,663,152 lb., valued at $6,321,770, an increase in quantity of 29,215,167 lb., and an increase in value of $2,841,454.

The production of copper this year was 57,720,290 lb., valued at $8,323,266, an increase in amount of 25,360,394 lb., or about 78 per cent. The value of the product was more than that of the preceding year by $3,993,512.

The other metals are specifically mentioned under the headings which follow this summary.

TABLE IV. shows the proportions of the total mineral productions made in each of the various districts into which the Province is divided.

It will be noted that this year the Eastern District has the honour of first place on the list, followed, in order of importance, by the Western, North-western, Southern, Central, and North-eastern Districts. The Western and Eastern Districts owe a considerable proportion of their output to the coal-mines situated within their limits, whereas, in the other districts, the production is chiefly from metal-mining.

The Western District also derives a fair proportion of its production from "Miscellaneous products," such as building materials, etc., due to the larger cities therein; this year this amounted to $2,560,967, as shown in Table V.

TABLE V. is an endeavour to show in some detail the production of those products, such as building materials, previously summarized under "Miscellaneous products," and which amounts this year to $2,858,710. Much difficulty has been found in obtaining reliable figures regarding these products, and in many cases they have had to be estimated; but, while the figures are not as complete as desired, they are at least approximate, and show what an important branch of mineral production this has become, despite the falling-off due to the war and depressed financial conditions.

TABLE VI. shows the statistical record of the placer mines of the Province from 1858 to 1923, and shows a total production of $76,962,203. The output for 1923 was $420,000, an increase, as compared with the previous year, of $55,200.

TABLE VII. relates entirely to the lode mines of the Province, and shows the quantities and values of the various metals produced each year since the beginning, in 1887, of such mining in the Province. The gross value of the product of these mines to date is $441,968,975; this figure includes the zinc production of 1909 and all subsequent years.

TABLE VIII. contains the statistics of production of the coal-mines of the Province. The total net amount of coal produced to the end of 1923 was 61,658,556 tons (2,240 lb.), worth $226,035,113. Of this, there was produced in 1923 2,453,223 tons valued at $12,266,115. In these figures of coal production the coal used in making coke is not included, as such coal is accounted for in the figures of output of coke. The amount of coal used in making coke in 1923 was 89,764 tons, from which was made 58,919 tons of coke, having a value of $412,433, an increase in amount

over the preceding year of 13,084 tons. The total value of the output of the collieries of the Province in 1923 was $12,678,548.

More detailed statistics as to the coal production of the Province and of the separate districts are given elsewhere in this Report.

Table IX. gives the details of production of metalliferous mines of the Province for the years 1920, 1921, 1922, and 1923, and the districts in which such productions were made, showing the tonnage of ore mined in each district, with its metallic contents and its market value.

The total tonnage of ore mined in the Province during the year 1923 was 2,421,839 tons, having a gross value of $25,347,062, and, with the placer gold, a total value of $25,767,062.

The following table shows the tonnage derived from the various Mining Divisions of the Province:—

	Tons.
Nass River Mining Division	838,478
Portland Canal Mining Division	145,995
Skeena Mining Division	88,300
Grand Forks Mining Division	45,019
Fort Steele Mining Division	489,876
Slocan and Slocan City Mining Divisions	62,245
Vancouver Island Mining Division	33,104
Mainland Mining Division	682,511
Other Mining Divisions	36,641
Total	2,421,839

In reports previous to 1910 there has been included in Table IX. the "Miscellaneous products," and in 1910 these were shown distributed to the various districts; the great increase of these products in the past few years has rendered it advisable that this table be reserved exclusively for metalliferous products, and so a new table (No. V.) was introduced in 1911, giving in some detail the output of these miscellaneous products.

In making comparisons of this table with similar tables in previous reports, the fact that "Miscellaneous" has been removed will have to be borne in mind.

Table X. presents in graphic form the facts shown in figures in the tables, and demonstrates to the eye the rapid growth of lode-mining in the Province, and also the fluctuations to which it has been subject.

It will be seen that, although coal-mining has been a constantly increasing industry during this whole period of thirty years, lode-mining did not begin, practically, until 1894, since when it has risen with remarkable rapidity, though not without interruption, until it reached its maximum in 1916, the $31,500,000 line. The total mineral production in 1910 reached the $26,000,000 line, in 1912 it reached the $32,000,000 line, in 1916 the $42,000,000 line, in 1920 it reached the $35,500,000 line, in 1921 it passed the $28,000,000 line, in 1922 was over the $35,000,000 line, and this year is over the $41,000,000 line.

Table XI. shows graphically the market-price fluctuations in each of the metals during each month from the year 1913 to 1923.

Table XII. shows graphically the metal prices for 1923.

GOLD.

Placer Gold. The recovery of placer gold for 1923 was $420,000, of which practically all was obtained in the North-eastern and North-western Districts, only about one-twentieth of the total coming from the other districts. An approximate apportionment is as follows: From Cariboo District, $230,000; Atlin, Stikine, and Liard Divisions of North-western District, $156,500; remaining parts of the Province, $33,500. This production for 1923 shows an increase over the preceding year of $55,200, or about 15.13 per cent.

During the previous four years the production of placer gold in the Province steadily decreased from the output of former years of between $500,000 and $700,000, which was due largely to the economic conditions of shortage and high prices of labour and supplies. The output for 1923 noted above brings this year's output above any year since 1917.

Gold from Lode-mining.

The value of lode gold produced in 1923 was $3,704,994, as compared with $4,089,684 in 1922, a decrease of $384,690, or about 9.40 per cent. The Portland Canal Division, of this, produced a gold value of $2,424,446, or more than the remainder of the Province. The *Belmont-Surf Inlet* mine in Skeena Division produced $613,072, and the Osoyoos Division $126,240, chiefly from the *Nickel Plate;* both of these latter properties being strictly gold-mines.

The following table shows the gold production of 1921, 1922, and 1923:—

Mining Division.	1921.	1922.	1923.
	Oz.	Oz.	Oz.
Portland Canal	40,104	123,527	117,293
Skeena	36,483	35,081	29,660
Nass	8,595	9,125	8,077
Trail Creek (Rossland)	44,980	8,256	6,983
Boundary-Yale	735	17,918	11,496
Coast (Southern)	750	....	4,876
Nelson	3,587	2,392	319
All others	429	1,557	541
Totals	135,663	197,856	179,245

SILVER.

The quantity of silver produced was 6,032,986 oz., worth $3,718,129, a decrease from the production of 1922 in quantity of 1,068,325 oz., and a decrease in value of $836,652, or nearly 18.36 per cent.

The market price of silver gradually and steadily fell during the whole year of 1920; it rose again in 1921 and 1922, but suffered a decline in 1923. The average price for the year 1920 was 100.9 cents an ounce, and for 1921 it was 62.65 cents, for 1922 it was 67.52 cents, while for 1923 it was 64.87 cents.

An accompanying diagram illustrates the fluctuations of market prices (pages 15 and 16).

The following table shows the silver production for 1921, 1922, and 1923:—

Mining Division.	1921.	1922.	1923.
	Oz.	Oz.	Oz.
Portland Canal	1,177,978	4,264,228	2,746,551
Nass	365,240	399,481	444,650
Slocan and Slocan City	188,142	1,104,628	1,086,582
Boundary District	160,051	211,730	228,521
Fort Steele	546,631	956,028	1,176,683
Ainsworth	115,772	53,736	91,478
Trail Creek	60,184	16,638	9,701
Coast (Southern)	8,548	14,368	126,305
Omineca	3,745	20,274	51,410
Windermere-Golden	18,508	27,004	46,340
Nelson	2,130	7,232	6,242
All others	26,460	25,964	18,523
Totals	2,673,389	7,101,311	6,032,986

The *Premier* mine in Portland Canal Mining Division was again the largest individual producer.

The Slocan Division produced 1,086,582 oz., while the Fort Steele Division produced 1,176,683 oz. and the Nass River Division 444,650 oz.

COPPER.

The amount of copper produced in 1923 shows, as compared with the previous year, a substantial increase in quantity, with a slight increase in the market selling-price. The production was 57,720,290 lb., which is 25,360,394 lb. more than the 1922 output; the value for this year is $8,323,266, which, compared with $4,329,754 made in 1922, shows an increase of $3,993,512.

The following table shows the production of copper, according to districts, in 1921, 1922, and 1923:—

Mining Division.	1921	1922	1923
	Lb.	Lb.	Lb.
Nass	34,067,185	30,334,584	32,950,826
Skeena	748,918	697,058	457,522
Coast (Southern)	1,456,146	617,691	23,197,014
Boundary-Yale	432,505	....	843,011
Trail Creek Division	2,277,392	684,930	271,091
All others	54,847	25,033	826
Totals	39,036,993	32,359,896	57,720,290

The Granby Company at Anyox in 1923 produced about 57 per cent. of the total of the Province, while the *Britannia*, on Howe sound, which is now back amongst the producers, having started their new mill in February this year, is responsible for about 38 per cent. of the total production. The remainder of the output of the Province was divided between the *Belmont-Surf Inlet* mine in Skeena District, the Rossland camp, Boundary-Yale Division, and the Tidewater Copper Company, on the west coast of Vancouver Island.

The market price of copper during the year 1920 dropped from about 19 cents at the beginning of the year to about 13 cents a pound; in 1921 the price remained between 12 and 13 cents, averaging 12.5 cents; while in 1922 the price for the year averaged 13.38 cents, or 0.9 cent better than the preceding year. During the first two or three months of 1923 the price was around 18 cents, but then began to descend, so that the average price for the year was 14.42 cents.

LEAD.

The total amount of lead produced in 1923 was 96,083,152 lb., valued at $6,321,770. This represents, as compared with the previous year, an increase in quantity of 29,215,167 lb., and in value of $2,841,454.

This represents an increase in quantity of 43 per cent. and an increase in value of 81 per cent. The average market price of lead in 1922 was 5.73 cents a pound, while in 1923 it was 7.26 cents.

The following table shows the production of lead, according to Mining Divisions, for the years 1921, 1922, and 1923:—

Mining Division	1921	1922	1923
	Lb.	Lb.	Lb.
Fort Steele	38,096,820	57,743,931	85,676,187
Slocan	1,614,425	7,633,024	7,612,544
Ainsworth	1,264,845	826,681	1,673,847
Windermere-Golden	385,000	815,618	1,124,370
Nelson	1,301	176,747	210,020
Grand Forks	51,268	144,251	161,038
Omineca	....	....	122,680
All others	18,629	107,183	81,896
Totals	41,402,288	67,447,985	96,083,182

From the above table it will be seen that there were increases in Fort Steele, Ainsworth, and Windermere Divisions, with a slight decrease in the Slocan.

The Fort Steele District continues to head the list, producing 85,676,187 lb. of lead, which is 90.74 per cent. of the total output of the Province for the year, while Slocan-Ainsworth produced 8.6 per cent. of Provincial product.

In the Slocan the largest producer was the *Silversmith*, followed by the *Wonderful* and *Bosun*.

In the Ainsworth Division the largest producer was the *Cork-Province*, followed by the Whitewater Mines, Ltd., *Kraa*, *Florence*, and a number of smaller shippers.

The production from Windermere-Golden was chiefly from the *Paradise* mine.

In the Omineca Mining Division the *Henderson* group produced 122,680 lb.

ZINC.

The quantity of zinc produced in 1923 amounted to 58,343,462 lb., which, compared with 57,146,548 lb. produced in 1922, shows an increase of 1,196,914 lb. This production is valued at $3,278,903, which shows an increase, as compared with the 1922 value, of $501,581, or about 18.6 per cent.

The zinc market in 1921 was not as much affected as the copper and lead markets by the transition period from war demands to peace conditions, with the result that the price of the metal did not fluctuate greatly and production continued uninterruptedly, but dull. In 1922 the market opened the year at 4.5 cents and rose gradually to 7 cents at the end of the year. The year 1923 saw a slight decline in the price of this metal, from close on 7 cents to a little under 6.5 cents at the close of the year. The average price for the year was 6.60 cents.

The following table shows the production of zinc, according to Mining Divisions, for the years 1921, 1922, and 1923:—

Mining Division.	1921.	1922.	1923.
	Lb.	Lb.	Lb.
Fort Steele	49,319,198	51,672,816	51,940,253
Slocan	65,984	5,164,661	6,249,305
Ainsworth	22,629	273,949	153,904
Omineca	11,561	21,071	.....
All others	.....	14,051	.....
Totals	49,419,372	57,146,548	58,343,462

From the above table it would seem that practically 89 per cent. of the zinc produced in the Province this last year was from the Fort Steele District. The output in this district was made chiefly by the *Sullivan* mine, and was due to a large tonnage of ore there mined and concentrated, the concentrates from which were shipped to the company's smelting plant at Trail for electrolytic refining.

In the Slocan District the heaviest shipper was the Silversmith Mines, Ltd., with a production of 2,905,138 lb. The next largest shipper was the Standard Silver and Lead Mining Company.

The figures for Ainsworth show a decrease for that district.

There was no zinc produced in the Omineca Division during 1923.

OTHER MINERALS.

Iron. So far there has been no metallic iron produced in British Columbia, but it has been strongly advocated in many quarters that the conditions are favourable for the establishment of an iron-smelting plant somewhere on the British Columbia coast. So far nothing definite has materialized, though there is apparently a prospect of such a plant being established. As is well known, there is on the Coast, in the aggregate, an adequate supply of magnetite-iron ore, quite sufficiently free from impurities as to be within the "Bessemer limit" to supply ore for such a plant.

The shipments of iron made during 1923 were 492 tons bog-iron ore from the *Iron King*, Alta lake, Vancouver Mining Division, and 243 tons magnetite from the *Good Hope*, Texada Island.

Platinum. The well-known fact of the wide occurrence of platinum throughout the Province in connection with our placer-gold deposits gives reasonable hope that such may be found in payable quantities and justifies further investigations. As far as reports received indicate, the only output this year is about $100 worth from the Similkameen District.

Molybdenite. Since the Armistice the market is dormant, like other metal prices, but nominal quotations vary from 45 to 50 cents a pound. No advice has been received of any shipment this year.

Chromite. In 1918 about 800 tons of chromite ore, carrying from 30 to 45 per cent. chromic oxide, was shipped from the *Mastodon* claim, Grand Forks Division; and a deposit on Scottie creek, near Clinton, was opened up, but no shipments were made. With the end of the war the market for chromite temporarily collapsed, as large stocks were available, with no purchasers in sight. It is believed that no ore was shipped since that date.

Manganese.—No manganese was produced in 1923.

Non-metallic Minerals. No fluorspar concentrates were shipped from the *Rock Candy* group, in the Grand Forks Division. This property is owned by the Consolidated Mining and Smelting Company. The growth of this property has been very interesting during the last two or three years. It is now equipped with an efficient concentrating-mill, which produced concentrates carrying about 88.5 per cent. calcium fluoride and 5.3 per cent. silica, and having a total value of about $100,000. The mineral is shipped to Trail smelter and is used for making hydrofluoric acid, which is used in the lead-refinery, and to other points in Canada and to the United States.

The Lillooet Soda Company produced 258 tons of sodium carbonate.

Deposits of hydromagnesite in the Clinton Division, which are reported to be large and of great purity, have attracted considerable attention during the past year.

Arsenic.—The *Nickel Plate* mine recovered 609 tons of oxide arsenic in 1923.

Talc.—Some 241 tons of talc was mined and ground in the Victoria Mining Division, for which product there appears to be a large demand.

Iron Pyrites.—At the *Sullivan* mine in East Kootenay some 1,382 tons of iron pyrites was mined and shipped to Trail.

Carbonate of Lime.—Twenty tons was produced at LaFrance creek, Kootenay lake, for agricultural purposes.

COAL.

The gross production of coal in 1923 was 2,542,987 long tons, of which 89,764 tons was made into coke, leaving the net production at 2,453,223 tons. These figures show a decrease, as compared with 1922, of 37,928 tons gross and of 58,620 tons net. The quantity of coke made was 58,919 tons, which is an increase of 13,084 tons as compared with 1922. For purposes of comparison the following table is shown:—

	1918.	1919.	1920.	1921.	1922.	1923.
Coal, gross.....tons, 2,240 lb.	2,578,724	2,408,948	2,686,774	2,569,639	2,580,915	2,542,987
Less made into coke "	276,479	141,407	101 649	85,644	69,072	89,764
Coal, net..... "	2,302,245	2,267,541	2,595,125	2,483,995	2,511,843	2,453,223
Coke made..... "	188,967	91,138	67,792	59,434	45,835	58,919

Summarizing the Provincial gross production of coal, the following table shows the output:—

	1920.	1921.	1922.	1923.
Vancouver Island mines.....tons, 2,240 lb.	1,698,254	1,625,931	1,754,656	1,574,663
Nicola and Similkameen mines ..... "	149,731	183,153	270,890	227,393
Crowsnest mines..... "	847,389	759,755	554,361	740,531
Omineca-Peace River .... "	1,400	800	1,008	400
Total quantity of coal mined. "	2,696,774	2,569,639	2,580,915	2,542,987
Less made into coke..... "	101,649	85,644	69,072	89,764
Net quantity of coal produced "	2,595,125	2,483,995	2,511,843	2,453.223

In addition to the above net production of coal, there was made by the collieries the coke production shown in the following table:—

	1920.	1921.	1922.	1923.
Vancouver Island collieries.....tons, 2,240 lb.	*Nil*	*Nil*	4,435	*Nil*
Nicola and Similkameen collieries... "	*Nil*	*Nil*	*Nil*	*Nil*
Crowsnest District collieries..... "	67,792	59,434	41,400	58,919
Total coke production . .. "	67,792	59,434	45,835	58,919

As will be seen from the above figures, the net coal production this year is 58,620 tons less than it was in 1922.

The greater part of the gross Provincial coal production is still being mined by three companies—the Crow's Nest Pass Coal Company of East Kootenay, the Canadian Collieries (Dunsmuir), and the Western Fuel Corporation of Vancouver island, which mined, collectively, 75 per cent. of the gross output.

Of the other collieries: In the Coast District, on Vancouver island, the Pacific Coast Coal Mines, Limited, is still closed down; the Nanoose Collieries, Limited, produced 85,938 tons; the Granby Company, from their colliery near Cassidy, produced 228,534 tons; and King & Foster, conducting operations at the Old Wellington, made a production of 11,072 tons; and, in addition, the East Wellington Coal Company produced 28,686 tons. In the Nicola Valley section of the district the Middlesboro Colliery Company mined 75,862 tons; the Fleming Coal Company, 3,954 tons; the Princeton Coal and Land Company, 16,645 tons; the Coalmont Colliery, 130,832 tons; and the Chu Chua Colliery, 100 tons.

In the Omineca District the Telkwa Collieries, Limited, shipped 335 tons. The Peace River coal property, a new producer in the Peace River canyon, shipped 65 tons. These two properties combined shipped 400 tons, and for convenience this has been included in the Coast District figures. The Aveling coal property did not ship during 1923.

In the East Kootenay District, in addition to the Crow's Nest Pass Coal Company, which produced 692,265 tons, the Corbin Coal and Coke Company produced 48,266 tons.

The collieries of the Coast District, including the Nicola-Princeton and Telkwa fields, are to be credited this year with about 70 per cent. of the total coal-output.

The gross output of the collieries of the Province for the past year was, as already stated, 2,542,987 tons, which includes 6,218 tons of coal added to stock.

Of this gross amount, there was sold for consumption in Canada, 1,491,737 tons; sold for consumption in the United States, 556,632 tons; sold in other countries, *nil;* making the total coal sales for the year 2,048,369 tons of 2,240 lb.

In addition to the coal sold, there was used in the manufacture of coke 89,764 tons, and used under companies' boilers, etc., 216,099 tons; while 182,537 tons was lost in washing and screening.

The coke sales of the Province for the past year amounted to 58,382 tons, which, together with 537 tons added to stock, make a total production of 58,919 tons.

The following table indicates the markets in which the coal and coke output of the Province was sold:—

Coal.	Coast District	Crowsnest Pass District	Total for Province
Sold for consumption in Canada ..... tons, 2,240 lb.	1,254,941	236,796	1,491,737
" export to United States ..... "	202,907	343,725	546,632
" export to other countries ..... "	*Nil*	*Nil*	*Nil*
Total coal sales	1,457,848	580,521	2,038,369
Coke.			
Sold for consumption in Canada ..... tons, 2,240 lb.	*Nil*	34,818	34,818
" export to United States ..... "	*Nil*	23,564	23,564
" export to other countries ..... "	*Nil*	*Nil*	*Nil*
Total coke sales	*Nil*	58,382	58,382

COLLIERIES OF COAST DISTRICT.

The collieries of the Coast District, which includes those on Vancouver Island and in the Nicola-Princeton fields, and two small collieries, one in Omineca District and the other in Peace River District, mined 1,802,456 tons of coal in 1923, of which 5,225 tons was added to stock, making 1,797,231 tons distributed from these collieries in 1923. This amount was distributed thus:—

	Tons.	Tons.
Sold as coal in Canada	1,254,941	
Sold as coal in United States	202,907	
Sold as coal in other countries	*Nil.*	
Total sold as coal		1,457,848
Used under companies' boilers, etc.		156,846
Used in making coke		*Nil.*
Lost in washing, etc.		182,537
		1,797,231
Plus coal added to stock		5,225
Gross output		1,802,456

The total coal sales of the Coast collieries for the year show, as compared with the sales of the previous year, a decrease of 230,002 tons, equivalent to about 13 per cent.

The coal sold in Canada by the collieries of the Coast District this year shows a decrease of 4,242 tons, or about 0.33 per cent. less than the preceding year; the amount exported to the United States was 215,769 tons less than the preceding year, a decrease of about 50 per cent.

No coke was produced in the Coast District this year.

On Vancouver Island six companies produced coal this year—the Canadian Collieries (D.), Limited, the Western Fuel Corporation of Canada, Limited, the Granby Consolidated Mining, Smelting, and Power Company, the Nanoose Collieries, Limited, the Old Wellington, and the East Wellington Coal Company; the majority of these companies each operate two, or more, collieries. The combined gross output of the Island collieries was 1,574,923 tons.

In the Nicola and Princeton coalfields of the Coast District the Middlesboro Colliery Company produced 75,862 tons of coal; the Fleming Coal Company, 3,364 tons; the Princeton Colliery, 16,645 tons; the Coalmont Collieries, 130,832 tons; the Chu Chua Collieries, 100 tons; the Community Coal and Coke Company did not produce during 1923.

The total output of this portion of the sub-district was 227,303 tons. The Telkwa Collieries produced 335 tons and the Peace River coal property 65 tons. The Arelling coal property did not ship during 1923.

EAST KOOTENAY COALFIELD.

There were only two companies operating in this district this past year—the Crow's Nest Pass Coal Company, operating two separate collieries, which together mined 692,265 tons; and the Corbin Coal and Coke Company, which mined 48,266 tons; making a gross output for the district for 1923 of 740,531 tons of coal.

The amount of coal actually distributed was 739,538 tons, which, together with 993 tons added to stock, shows the total production of 740,531 tons.

Of this gross tonnage, 89,764 tons was used in the manufacture of coke, of which there was produced 58,919 tons (2,240 lb.), of which 58,382 tons were sold and 537 tons added to stock.

The following table shows the distribution made of the coal of this district:—

	Tons.	Tons.
Sold as coal in Canada	236,796	
Sold as coal in United States	353,725	
Total sold as coal		590,521
Used by the companies in making coke		89,764
Used by the companies under boilers, etc.		59,253
		739,538
Plus coal added to stock		993
Gross output		740,531

BUILDING MATERIALS.

The output during 1923 of structural materials, such as cement, lime, building-stone, sand and gravel, brick and other clay products, was more than in the preceding year, being $2,809,292 as against $2,533,926.

Approximately 90 per cent. of the total production of building materials comes from the Coast District, and the larger part of this finds its markets in the Coast cities.

It is probable that an output amounting to about $1,500,000 represents the steady yearly demand for these materials for use in repairs, renewals, and various small demands, with a little more construction-work in 1923.

Cement production is greater than 1922.

Building-stone. Public works and several large buildings have caused the quarrying of a good deal of building-stone, and the production in 1923 is valued at $108,110.

Excellent building-stone of various sorts is found in abundance in almost every part of the Province; the fact of its widespread distribution has, however, been somewhat against the establishment of large quarrying industries, as a sufficient local supply could always be obtained, and, except within reach of the larger cities, few regularly equipped quarries have been opened.

On the Coast, chiefly between Vancouver island and the Mainland, there are several well-equipped quarries taking out granite, sandstone, and andesite, all of excellent quality. These quarries supply the stone building material of the Coast cities, and have also exported to the United States.

A detailed description of the more important quarries was given in the Report of this Bureau for 1904.

Red Brick. The sale of red brick during 1923 was about 7,800 M.; the price varies from $12 to $16 a thousand, according to quality and demand. This small output shows very clearly that but little construction-work has been carried on. It is probable, however, that a considerable quantity of brick is still imported into the Province.

Firebrick. The only company producing firebrick in the Province is the Clayburn Company, Limited, with a plant at Clayburn. The fireclay is found here as a bed occurring in bedded rocks of Eocene age. Shales, sandstones, and conglomerates, all but little consolidated, make up this sedimentary series. The shales are quarried or

mined for brick-making and one bed is an excellent fireclay. Associated with these rocks is a bed of lignite which is sufficiently good to be used for firing the boilers of the plant. Firebrick is the principal manufactured article produced by this company, but, in addition, considerable quantities of paving-brick, tiles, drain-pipes, fireclay blocks and shapes, and prepared fireclay are made.

Lime.

The manufacture of lime is conducted in a small way at a large number of points in the Province, but only on the Coast has any attempt been made at more extensive operations. In the neighbourhood of Victoria, on Esquimalt harbour, two kilns are in operation, and there are two kilns on Saanich inlet. On Texada Island —in addition to the plant at Marble bay—a new and extensive plant was erected at Blubber bay a few years ago. The limestone being used is of exceptional purity, but in some instances the limestone-beds are cut by igneous dykes which have to be rejected, and this somewhat increases the cost of quarrying.

The production of lime and limestone for 1923 is valued at $480,210, as compared with $400,860 in 1922. Of this about $14,410 worth of limestone was quarried for use as smelter flux by the Consolidated Mining and Smelting Company and $10,180 worth quarried by the paper and pulp mills for their own use.

Crushed Rock and Gravel.

The returns for crushed rock and gravel indicate an increased demand for this material, the value of 1923 production being $151,102, although some of the plants have not been in operation for the past two or three years. During the boom years of 1911 and 1912 a number of well-equipped plants were put up near Vancouver and Victoria for supplying washed sand and gravel, properly screened to size. Some of these companies use a system of mining the gravel by hydraulic streams and carrying the product to the screens by the water used.

BUREAU OF MINES.

WORK OF THE YEAR.

The work of the Bureau of Mines naturally increases year by year, this growing activity being due to the following causes: The extension of the mining area of the Province, with the proportional increase in the number of mines; the increasing desire of the outside public for the free information which the Bureau supplies with regard to the various mining districts and camps, and the appreciation by the prospector of the fact that he may obtain, gratis, a determination of any rock or mineral which he may send to the Bureau.

The routine work of the office, and the preparation and publication of the Report for the year just ended, followed by the examination in the field of as many of the mines and mining districts as the season would permit, together with the work of the Laboratory, fully occupied the staff for the year.

The permanent staff of the Bureau now consists of the Provincial Mineralogist and Assayer, Wm. Fleet Robertson, B.A.Sc.; the Assistant Provincial Assayer and Provincial Analyst, D. E. Whittaker; John Adams as Laboratory Assistant; H. T. Nation, general office assistant; and H. Pearson, clerk.

MINERAL SURVEY DISTRICTS AND RESIDENT ENGINEERS THEREOF.

During the session of 1917 the Hon. the Minister of Mines brought in the "Mineral Survey and Development Act," which was passed on May 19th, 1917, and under the provisions of which the Province was divided into six Mineral Districts, to each of which there was appointed a Resident Mining Engineer with headquarters at a centrally located point in such district.

In the district to which he was appointed the Resident Mining Engineer is expected to devote his whole time to the performance of the duties of his office, and to carry on continuously a mineral survey of his district, keeping records of the same and of the mining and mineral developments taking place, and at the same time to assist prospectors and others with such advice as may be necessary and may come within the scope of a mining engineer's work.

Aside from special reports which may be called for by the Minister, the Resident Mining Engineers are expected annually to make a comprehensive report covering all matters relating to mining, mine development, and prospecting that have occurred within the year in their respective districts.

These annual reports of the Resident Mining Engineers are given later in this general Report, and form the basis of the information given in respect to the mineral industry and its development within the Province.

The following are the six Mineral Districts into which the Province is divided, with the Mining Divisions included in each and the location of the permanent office of the district, with the name of the Resident Mining Engineer appointed to each district:—

The North-western Mineral Survey District (No. 1) shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Atlin, Stikine, Liard, Skeena, Nass River, Portland Canal, Bella Coola, and Queen Charlotte; and shall have its permanent survey station and office at the City of Prince Rupert. Resident Mining Engineer, Geo. A. Clothier, B.Sc.

The North-eastern Mineral Survey District (No. 2) shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Omineca, Peace River, Cariboo, and Quesnel; and shall have its permanent survey station and office at Hazelton. Resident Mining Engineer, John D. Galloway, M.Sc.

The Central Mineral Survey District (No. 3) shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Clinton, Lillooet, Kamloops, Ashcroft, Nicola, Vernon, and Yale; and shall have its permanent survey station and office at the City of Kamloops. The Resident Mining Engineer is Angus W. Davis, B.A.Sc.

The Southern Mineral Survey District (No. 4) shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Similkameen, Greenwood, Grand Forks, and Osoyoos; and shall have its permanent survey station and office at the City of Grand Forks. Resident Mining Engineer, Philip B. Freeland.

The Eastern Mineral Survey District (No. 5) shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Golden, Windermere, Fort Steele, Ainsworth, Slocan, Slocan City, Trout Lake, Nelson, Arrow Lake, Revelstoke, Lardeau, and Trail Creek; and shall have its permanent survey station and office at the City of Revelstoke. Resident Mining Engineer, A. G. Langley, B.Sc.

The Western Mineral Survey District (No. 6) shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Nanaimo, Alberni, Clayoquot, Quatsino, Victoria, Vancouver, and New Westminster; and shall have its permanent survey station and office at the City of Nanaimo. Resident Mining Engineer, W. M. Brewer.

ASSAY OFFICE.

The following is a summary of the work of the Assay Office of the Bureau of Mines for the year 1923 as reported by the Assistant Provincial Assayer, D. E. Whittaker:—

During the year 1923 there were made by the staff in the Government Assay Office 3,639 assays or quantitative determinations; of these the majority were for the Bureau of Mines or for the other departments, for which no fees were received.

The fees collected by the office were as follows:—

Fees for analyses	$ 261 50
Fees for assaying	151 27
Fees for assayers' examinations	30 00
Total cash receipts	$ 442 77
Determinations and examinations made for other Government departments for which no fees were collected—	
Attorney-General's Department	$ 359 00
Agricultural Department	1,140 00
Board of Health	380 00
Treasury Department	37 25
Other departments	197 00
	$2,713 25
Value of work done outside of Mines Department work	$3,156 02

The value of gold melted during the year 1923 was $5,202 in 17 lots, as against $4,895 in 17 lots in 1922.

Free Determinations.

In addition to the above quantitative work, a large number of qualitative determinations, or tests, were made in connection with the identification and classification of rocks or minerals sent to the Bureau for a report; of these no count was kept, nor were any fees charged, as it is the established custom of the Bureau to examine and test qualitatively, without charge, samples of minerals sent in from any part of the Province, and to give a report on the same. This has been done for the purpose of encouraging the search for new or rare minerals and ores, and to assist prospectors and others in the discovery of new mining districts, by enabling them to have determined, free of cost, the nature and probable value of any rock they may find. In making these free determinations, the Bureau asks that the locality from which the sample was obtained be given by the sender.

EXAMINATIONS FOR ASSAYERS.

REPORT OF D. E. WHITTAKER, SECRETARY OF BOARD OF EXAMINERS.

I have the honour, as Secretary, to submit the Annual Report for the year 1922 of the Board of Examiners for Certificates of Competency and Licence to Practise Assaying in British Columbia, as established under the "Bureau of Mines Act Amendment Act, 1898."

A meeting of the Board of Examiners was held on May 18th and December 10th. No candidates applied for examination. Two candidates applied for exemption under section 2, subsection (2), of the Act, and the Board recommended that Certificates be issued to them.

In accordance with the recommendation of the Board, Certificates have been duly issued by the Honourable the Minister of Mines to the two candidates.

LIST OF ASSAYERS HOLDING PROVINCIAL CERTIFICATES OF EFFICIENCY UNDER THE "BUREAU OF MINES ACT AMENDMENT ACT, 1899."

(Only the holders of such certificates may practise assaying in British Columbia.)

Under section 2, subsection (1).

Adams, J. B. .....Victoria.
Archer, E. G. .....Anyox.
Armstrong, N. .....Vancouver.
Ayres, D. A. .....
Austin, John W. .....Vancouver.
Backus, Geo. S. .....Britannia Beach.
Baker, C. S. H. .....
Bagus, N. J. .....Vancouver.
Barke, A. C. .....
Beilby, E. B. .....Vancouver.
Bernard, Pierre .....Monte Christo, Wash.
Bishop, Walter .....Grand Forks.
Boulding, J. D. .....Vancouver.
Broughton, F. W. .....Vancouver.
Buchanan, James .....Trail.
Buehman, A. S. .....Trail.
Campbell, Colin .....New Denver.
Carmichael, Norman .....Clifton, Arizona.
Church, George B. .....
Clarke, E. R. .....Vancouver.
Cobeldick, W. M. .....Scotland.
Collison, H. .....Cobham, England.
Comrie, George H. .....Vancouver.
Cotton, G. W. .....Trail.
Craufurd, A. J. F. .....Rossland.
Crerar, George .....
Crompton, S. V. .....Vancouver.
Cruickshank, G. .....
Davidson, J. R. .....Vancouver.
Day, Athelstan .....Dawson.
Dedolph, Ed. .....
Dockrill, Walter R. .....Chemainus.
Dunn, G. W. .....Rossland.
Farquhar, J. B. .....Vancouver.
Fingland, John J. .....Kaslo.
Gardner, C. S. .....Victoria.
Grosvenor, F. E. .....Vancouver.
Hamilton, Wm. J. .....Anyox.
Hannay, W. H. .....Rossland.
Harsant, R. C. C. .....Port Essington.
Hart, P. E. .....
Hawkins, Francis .....Silverton.
Hawes, F. B. .....Vancouver.
Hodgson, A. R. .....Anyox.
Hook, A. Harry .....Greenwood.
Hurter, C. S. .....Prince Rupert.
Irwin, George E. .....Vancouver.
John, D. .....Haileybury, Ont.
Kiddie, Geo. R. .....California.
King, R. .....
Kitto, Geoffrey B. .....Victoria.
Lang, T. F. .....Vancouver.
Langley, A. S. .....Crofton.
Laucks, I. F. .....Seattle.
Lee, Fred E. .....Trail.
Lee, Geo. M. .....Grand Forks.
Ley, Richard H. .....Victoria.
Levy, Frank .....
Lindsay, W. W. .....Kimberley.
Locke, V. F. .....Vancouver.
Longworth, F. J. .....Boyds, Wash.
Manning, S. M. .....Trail.
Martin, S. J. .....
Marsh, Richard .....Republic, Wash.
Marshall, H. Jukes .....Vancouver.
Marshall, William S. .....Ladysmith.
Meale, Eric A. .....East Helena, Mont.
Merrifield, T. T. .....Trail.
Miles, Arthur D. .....
Milne, A. S. .....Vancouver.
Mitchell, Charles T. .....Copper Cliff, Ont.
McCormick, Alan F. .....Ruth, Nevada.
MacDonald, Alec. C. .....Vancouver.
MacDonald, J. S. .....Vancouver.
McLellan, R. D. .....Vancouver.
Morgan, Richard .....Trail.
Nicholls, Frank .....Norway.
Okell, S. E. .....Vancouver.
Parker, Robt. H. .....
Parsenow, W. L. .....
Perkins, Walter G. .....
Pickard, T. D. .....Vancouver.
Pirrie, Noble W. .....Ottawa, Ont.
Poole, H. W. .....Vancouver.
Prior, C. E. .....Hedley.
Raht, K. .....Trail.
Richmond, Leigh .....Duncan.
Robertson, T. R. .....Vancouver.
Rodgers, Ch. B. .....
Rogers, G. J. .....South Vancouver.
Rombauer, A. B. .....Butte, Mont.
Schroeder, Curt A. .....
Segsworth, Walter .....Toronto, Ont.
Shepherd, G. H. .....North Vancouver.
Sharpe, Bert N. .....
Shore, J. T. .....Vancouver.
Sim, Chas. John .....Monte Carlo.
Sloan, Wm. .....Vancouver.
Snyder, Blanchard M. .....
Steven, Wm. Gordon .....
Stimmel, B. A. .....Trail.
Stockly, Galt .....Princeton.
Sundberg, Gustave .....Mexico City.
Tally, Robert E. .....Spokane, Wash.
Taylor, E. S. .....Vancouver.
Taylor, H. L. .....Vancouver.
Teed, A. J. .....Vancouver.
Thirkell, V. R. .....Vancouver.
Thomas, Percival W. .....Vancouver.
Tretheway, John H. .....
Turner, H. A. .....Vancouver.
Vance, John F. C. B. .....Vancouver.
Van Agnew, Frank .....Siberia.
Vaughan-Williams, V. L. ..California.
Wales, Roland T. .....
Watson, Wm. J. .....Ladysmith.

Under section 2, subsection (1)—Continued.

Watson, Thomas	Vancouver.
Welsh, J. Cuthbert	Butte, Mont.
Wells, Ben T.	
West, Geo. G.	Vancouver.
Wenerstrom, L. H.	Anyox.
Whittaker, Delbert E.	Victoria.
Widdowson, E. Walter	Nelson.
Willemar, Douglas R.	New Hazelton
Williams, W. A.	Vancouver.
Williams, Eliot H.	
Williams, J. R.	Vancouver.
Wimberley, S. H.	Nevada, U.S.A
Youngs, T. N.	Victoria.

Under section 2, subsection (2).

Archer, Allan	
Blaylock, Selwyn G.	Trail.
Bissett, D. G.	Trail.
Bolton, George E.	Silverton.
Brennan, Charles Victor	Victoria.
Browne, R. J.	Rossland.
Browne, P. J.	Nelson.
Bryant, Cecil M.	
Burwash, N. A.	
Cavers, Thomas W.	
Clothier, George A.	Prince Rupert.
Cole, Arthur A.	Cobalt, Ont.
Cole, G. E.	Rossland.
Cole, L. Heber	Ottawa, Ont.
Conway, E. J.	Vancouver.
Coo, Cecil William	Toronto, Ont.
Coulthard, R. W.	
Cowans, Frederick	
Dawson, V. E.	Trail.
Dempster, R. C.	Rossland.
Dempster, A. S.	Rossland.
Dixon, Howard A.	Toronto, Ont.
Eardley-Wilmot, V. L.	Rossland.
Eldridge, Gardner S.	Vancouver,
Fotheringham, D. F.	Trail.
Galbraith, M. T.	
Gilman, Ellis P.	Vancouver.
Gray, Stanley	Trail.
Green, J. T. Raoul	Blairmore, Alta.
Guess, George A.	Toronto, Ont.
Harding, Wilson M.	
Heal, John H.	
Hearn, Roy D.	Trail.
Hilliary, G. M.	Idaho, U.S.A.
Johnston, William Steele	Lachine, Que.
Kaye, Alexander	Vancouver.
Kendall, George	Vancouver.
Kidd, G. L.	Edmonton, Alta.
Kilbourne, Geo. H.	Vancouver.
Lathe, Frank E.	Grand Forks.
Lay, Douglas	Rossland.
Lewis, Francis B.	South Africa.
Mellish, Albert Henry	Premier.
Merrit, Charles P.	
Murphy, C. J.	St. Catharines, Ont
Musgrave, W. N.	England.
McArthur, Reginald E.	
McBean, K. D.	Trail.
McDiarmid, S. S.	
McGinnis, Wm. C.	Queen Charlotte Ids.
McKay, Robt. B.	Vancouver.
McLellan, John	Skidegate.
McMurtry, Gordon O.	
McNab, J. A.	Thompson, Nevada.
McPhee, W. B.	
McVicar, John	Edmonton, Alta.
Maclennan, F. W.	
Moran, P. J.	Vancouver.
Newton, W. E.	Sandon.
Oliver, Chas. E.	Vancouver.
Oughtred, S. W.	Ainsworth.
Outhett, Christopher	Kamloops.
Pemberton, W. P. D.	Victoria.
Reid, J. A.	Cobalt, Ont.
Ritchie, A. B.	Nelson.
Roaf, J. R.	
Roscoe, Harold M.	Anyox.
Rose, J. H.	Thompson, Nevada.
Rutherford, R. C.	Trail.
Sampson, E. H. S.	Riondel.
Scott, John Mitchell	Stewart.
Scott, Oswald Norman	
Shannon, S.	
Sharpe, G. P.	Midland, Ont.
Shorey, P. M.	Trail.
Sloan, David	Three Forks.
Stevens, F. G.	Mexico.
Stewart, A. G.	Vancouver.
Stroud, J. E. C.	Anyox.
Sullivan, Michael H.	Kellogg, Idaho.
Sutherland, T. Fraser	
Sutherland, Wm.	Glasgow, Scotland.
Swinney, Leslie A. E.	
Thompson, W. K.	Trail.
Thomson, H. Nellis	Anaconda, Mont.
Watson, A. A.	
Watson, Henry	
Weir, William	Anyox.
Willis, F. S.	Trail.
Winslow, R. H.	Vancouver.
Wilson, Ridgeway R.	Victoria.
Workman, Ch. W.	
Wright, Richard	Rossland.
Wynne, Llewellyn C.	
Yuill, H. H.	

Under section 2, subsection (3).

Carmichael, Herbert	Victoria.
Galloway, J. D. (Resident Engineer.)	Victoria.
Harris, Henry	Tasmania.
Hedley, Robt. R.	Vancouver.
Kiddle, Thos.	California.
Marshall, Dr. T. R.	London, England.
McKillop, Alexander	Vancouver.
Pellew Harvey, Wm.	London, England.
Robertson, Wm. Fleet (Provincial Mineralogist.)	Victoria.

PREVIOUSLY ISSUED UNDER THE "BUREAU OF MINES ACT, 1897," SECTION 12.

Pinder, B.	
Thompson, James B.	Vancouver

NORTH-WESTERN MINERAL SURVEY DISTRICT (No. 1).

REPORT FOR YEAR 1923.

By George A. Clothier, Resident Mining Engineer.

INTRODUCTORY.

The North-western Mineral Survey District (No. 1) is comprised of the following eight Mining Divisions: Queen Charlotte, Bella Coola, Skeena, Nass River, Portland Canal, Stikine, Atlin, and Liard, totalling about 700 miles in length, of which the northern portion, of about 400 miles, lies behind or east of the Alaska panhandle. There are therefore in this district about 300 miles of very accessible prospecting area along the Coast and islands, and 400 miles of interior country where transportation is much more difficult.

As I have briefly pointed out each year in my report, the district can best be considered, from the mineral standpoint, by dividing it into its three natural mineral-belts—the Coast Range or Central Belt, the Western Contact Belt on the western flank of the granite, and the Eastern Contact Belt on the eastern or interior flank. Each of these zones has its own characteristic minerals, and this subdivision should therefore enable the prospector to make his choice of fields.

The Coast Range or Central Belt may be termed the copper-belt, as exemplified by Anyox, *Outsider* on Portland canal, and *Marble Bay* and *Britannia* farther south. The Western Belt produces mainly copper, but contains numerous small gold-quartz veins. The Eastern Belt is noted for its gold, silver, and lead deposits, as shown by *Premier* and Salmon River area, *Engineer* mine, *Dolly Varden*, and Alice Arm area, and the Ootsa Lake and Whitesail Lake areas farther south.

In considering the Coast Range Belt, the following extract from the conclusions of F. E. and C. W. Wright, of the United States Geological Survey, in their report on south-eastern Alaska, and which applies directly to British Columbia, states: "Within the granite area itself are occasional belts of sedimentary rocks in a highly metamorphosed condition. They vary from argillites, to mica, hornblende, and calcareous schists of various types, even marble, and occur in long bands intensely folded. These included schist-belts are usually not wide and more appear near the mountain-tops than at sea-level. They are usually intensely mineralized with sulphides, especially pyrite, and near the mountain-tops show abundant evidence of the contact metamorphism. They were directly above the intrusive mass and were evidently in the most favourable position to be affected by magmatic waters and heat escaping from the intrusions, so that they are the most heavily mineralized bodies."

This form of ore-body is well illustrated by the Anyox mines, the *Outsider* and other deposits at Maple bay, and exceptionally well in the Ecstall River pyrite-deposits, which attain a width of 300 feet or more of solid sulphides, mainly pyrite.

Besides the above important form of ore-deposition, there are within the granite-belt quartz-filled fissures, replacement veins following dykes, and quartz-filled shear-zones. The prospector has therefore a wide range of ore-bodies to look for.

The Western Contact Belt includes, for this report, the inshore islands as well as the Queen Charlottes.

The reason for the occurrence of copper on the west side of the granite and the gold, silver, and lead ores on the east side has been discussed. F. E. and C. W. Wright say: "It is probable that at many points along the western flanks of the batholiths the schists now visible were so deeply buried at the time of the intrusion that the invading granite did not alter them so materially as to produce wide contact change. It is significant that in these deep-seated schists and gneisses near the granite-contact no ore-bodies of consequence have been found, while rocks farther away from the granite and nearer the surface during the invasion in many places show contact metamorphism as in spotted schists and contain valuable metalliferous deposits."

S. J. Schofield, in a chapter on "Ore Deposits of British Columbia" in the 1922 Summary Report of the Geological Survey of Canada, says: "A fact that may throw some light on the subject is that the copper-deposits are not confined to true fissure-veins, but resemble impreg-

nations of the country-rock by minerals such as pyrite, pyrrhotite, chalcopyrite, which indicate conditions of high temperature and pressure, even bordering on those of contact deposits, whereas the gold-silver, silver-lead deposits are usually, though not always, associated with fissure-veins filled under conditions of moderate temperature and pressure, the gold-silver being characterized by the presence of such minerals as gold, silver, argentite, pyrargyrite, etc., in a quartz gangue, and the silver-lead by galena, zinc-blende, tetrahedrite in a gangue of calcite, siderite, and sometimes quartz."

The Eastern Contact Belt extends in this district from Terrace north to the Yukon, a distance of about 450 miles. The general geological characteristics of this belt can best be expressed by the following excerpt*:—

"The character of the invaded sedimentaries east of the island border of the granite is noticeably different from the west. The slates and sandstones are less altered and typical schists are rare. Folding, and particularly faulting, are common and characteristic of the whole complex.

"The intruded rocks are often indurated (hardened) and heavily mineralized with sulphides near the contact and show evidences of metamorphism by the intrusives. The geological interpretation of those data indicates clearly that the rocks east of the massifs were less deeply buried at the time of the intrusion than on the coastal side. In other words, the inland rocks were then above the zone of deep-seated metamorphism or rock-flowage, and were therefore profoundly affected by the invading intrusions and accompanying pneumatolytic solutions. Furthermore, the mineral-bearing solutions emanating from the granite encountered new conditions of temperature and pressure on entering the adjacent sedimentary rocks, and deposited as supersaturated solutions in these new environments a portion of their dissolved contents, especially metallic sulphides and silicates."

In discussing this question, Schofield says: "It is well known that the roof of a batholith is always intensely metamorphosed by the ascending hot solutions from the underlying molten magma. On the other hand, the deeper and more vertical contacts do not show contact metamorphism to the same degree, not only as regards intensity, but also as regards areal extent.

"If the batholith and the intruded rocks are exposed in a plane normal to the vertical axial plane of the batholith, the plane would consist of a core of granite surrounded by a contact zone of approximately the same width.

"On the other hand, if the batholith and intruded rocks are cut obliquely, the roof rocks will be preserved higher up on the low side, whereas on the high side the highly metamorphosed roof-rocks will be entirely removed and the contact will be undulating and fairly even. The contact-metamorphic zone will be very narrow on the high side and very wide and irregular on the low side. In addition, the low side will be marked by many roof pendants of all sizes, whereas the high side will be almost free from them. It follows that, in the wide metamorphic zone on the western flank, ore-deposits of high temperature and pressure would be characteristic, but on the eastern flank a few ore-deposits of high temperature and pressure might occur along the immediate contact of the granite. Owing, however, to the very low conductivity of rocks, the zone of these deposits would be very narrow and would rapidly give way to ore-deposits characterized by minerals of medium temperature and pressure. The deposits of the latter variety on the western flank are covered by the waters of the Pacific ocean."

These different mineral-belts in the Province are being constantly investigated and reported on by the Geological Survey of Canada, and the reader who is interesting himself in the Coast and North-western sections is referred to the following publications for useful information: "The Atlin District," by D. D. Cairnes, Memoir No. 37; "The Unuk River Mining Region," by F. E. Wright, Summary Report, 1905, and U.S. Geological Survey Bulletin 347; "The Portland Canal District," by R. G. McConnell, Memoir No. 32, Geological Survey, Canada; "Salmon River District," by J. J. O'Neil, Summary Report, G.S.C., 1918; "Salmon River District," by S. J. Schofield and Geo. Hanson, Summary Report, G.S.C., 1920, Part A; "Entsuk Lake District," by R. W. Brock, Summary Report, G.S.C., 1920, Part A; "Upper Kitsault River, Alice Arm," by Geo. Hanson, Summary Report, G.S.C., 1921, Part A; "Coast and Islands of British Columbia between Burke and Douglas Channels," by V. Dolmage, Summary Report, G.S.C., 1921, Part A; "Geology and Ore Deposits of Salmon River District, British Columbia," by S. J. Schofield and Geo. Hanson, G.S.C., Memoir 132.

* U.S. Govt. Survey, Bull. 347.

THE MINING INDUSTRY.

The industry in this district for this year, though showing a decrease in production, has, on the whole, been very progressive. I estimate that more money has been expended, outside of the necessary development by operating properties, in exploration and development-work this year than ever before in the same length of time, approximating about $500,000.

In a great many cases the results have been decidedly gratifying. One new producer has been "brought in," and there seems every reason to believe that two or three others will reach the producing stage in a short time.

There was, of course, the usual spring flurry of bonding properties. Many inquiries were received from London interests, caused by the favourable outlook for the British Columbia Silver Mining Company, and the consequent advancement of the shares of the Selukwe Gold Mining and Finance Company, Limited, to an unreasonable figure. My advice to Old Country capital was, and is, to maintain a permanent representative in the field here, who will then be in touch with the whole situation all the time, and not just for a week or two of each season. The immediate necessity for the mining industry in this new country is capital, and there are undoubtedly worthy opportunities for the investment of English and other capital, but there should be a representative on the ground to investigate the opportunities as they come up.

Exaggerated statements by prospectors, promoters, and budding operators are ultimately derogatory to mining. There is no comparison between printers' ink and the hammer and drill for actually opening up a property.

Exaggerated prices for prospects is about the surest way of holding on to them. I judge it better to *sell* five prospects at $10,000 each than *hold* one for $50,000.

The Portland Canal country has again been the scene of greatest activity in the district, and the results of this year's development have greatly improved the outlook for the permanency of Stewart camp. The outstanding features of the mining situation is the bringing of the *Outsider* group to a producing stage by the Granby Company; the installation of adequate power at Anyox; the progress made by the same company with its concentrator at Anyox; and the deeper development of the Premier Gold Mining Company's property on Salmon River.

Encouraging features are the promising development of the *Dunwell* and *Indian*.

It is difficult to explain or understand why such surface showings as are found in the Alice Arm country are not acquired for exploration on a large scale. The *Dolly Varden* situation has, I think, been too far-reaching and has been taken too seriously by operators.

In the north there is a little development being done in the Atlin country.

The industry will be reviewed in detail under its three main divisions—namely, prospecting, development, and production.

PROSPECTING.

I have had a great many inquiries during the year from men outside the Province as to the most favourable sections for prospecting, how to get there, where to outfit, etc., and I therefore believe that a pamphlet compiled by the different Resident Engineers, giving such information in all detail, and published by the Department for distribution, would be very useful.

The brief geological data given in the introduction of this report will give the prospector an idea of the conditions governing the deposition of ore-bodies in each mineral-belt of the district.

S. J. Schofield, in his chapter on the "Ore Deposits of British Columbia,"* gives some very interesting information, which, though general, may be applied to any section of the Province. His conclusions are that the most favourable rocks for containing commercial ore-bodies are: (1) Limestones; (2) granite family (monzonite, granodiorite); (3) diorite (gabbro family); (4) volcanic tuff; (5) quartzites; (6) slates.

The stratified or bedded rocks, limestone, tuffs, quartzites, and slates will, in general, carry the gold, gold-silver, silver, and silver-lead deposits, while the copper ores favour the basic igneous rocks, such as the diorite-gabbro family. Of course there are many exceptions to the above, and there are many other rock types with which minerals are associated.

Prospecting has been very active throughout the district this year, mainly on ground already staked, and in most cases held for some years. It has been a noticeable fact in the last two or three years that prospectors are doing more exploratory work on their claims instead of ranging so far into new fields and neglecting ground they already hold.

* Memoir 132, Geo. Survey, Canada.

The Lakelse and Kitsumgallum Lakes sections are gradually making themselves known and more interest was taken in these sections this year than usual. Both areas are reached from Terrace, on the Canadian National Railway, about 95 miles from Prince Rupert. The Lakelse Lake or Thornhill Mountain area is south of the Skeena river, but the Provincial Government is now building a steel bridge just above Terrace, which will serve that section for miles and permit of ores being hauled to Terrace for shipment.

Kitsumgallum lake is about 20 miles north from Terrace, over a good motor-road to the foot of the lake, which is about 8 miles long. The country surrounding the lake is along the Eastern Contact Belt and is a first-class area to prospect. Transportation to the railway is fair and will be improved. Supplies and outfit can be obtained at Terrace and hauled by auto-truck to the lake, where boats may be had. From the upper end of the lake there is a fair trail through to the Nass river at Alyansh, which point can also be reached by boat up the Nass river from Mill bay. A mail-boat makes the trip once a week up the Nass.

The Alice Arm section has a number of resident prospectors, who do a great deal of work on their individual holdings each year, and therefore developing that section, regardless of the fact that very little interest has been taken in mining there for the past two years, as a result of the non-operation of the *Dolly Varden* mines. There is excellent prospecting ground for any one up Roundy and Lime creeks, Illiance river, and the Kitsault and tributary valleys. The Coast-plying boats call at Alice Arm once a week and at Anyox twice a week. There is a launch service between Anyox and Alice Arm.

The head of Hastings arm is a good prospecting country, especially above the granite contact. One would have to get to the head of the arm by boat from Anyox, and from there the Mines Department is constructing a trail up the river to several mineral-showings in the same mineral-belt as the Alice Arm-Kitsumgallum Lake Belt.

The Portland Canal country has again been the important mining section this year and prospecting has consequently been more active than elsewhere in the district. This whole area is reached by way of Stewart, where coastwise boats call three times a week during the summer. Supplies and outfits can be bought at Stewart, and though it is an old section there is still room for prospectors. Down the canal, in the granite batholith, such showings as are being opened up on the *Outsider* claims make prospecting worth while, and the gold-quartz showings on the Georgia river, though small, might be profitable to a prospector.

The Marmot River valley, 3 miles south of Stewart on the east side of the canal, affords an accessible and encouraging field for prospecting. Some high-grade showings are being opened up.

Up Bear river there is a main road and trail for 36 miles through a mineral belt all the way to Meziadin lake. A branch prospector's trail from Meziadin lake, at Surprise creek, follows the mineral-belt for a distance of 20 miles or more. This trail is not built for a pack-horse trail, but enables prospectors to get through the country with some degree of speed and comfort.

Branch trails up the main tributary creeks make this whole valley very easily reached and covered by a prospector, who can have his supplies taken on pack-horse to any point from which he can work. The Provincial Government this year completed a bridge across the Bear river at a cost of approximately $35,000, putting the entire valley in good shape for transportation.

The Salmon River valley has a fine automobile road from Stewart to the *Premier* mine, a distance of about 14 miles. A pack-horse trail branches from this road at 13 Mile and serves the west side of Cascade creek to the head of the Salmon River glacier, about 26 miles from Stewart. Also a branch road from the *Premier* road has been built up the east side of Cascade creek, from which branch trails provide access to all the upper part of Salmon River valley. Stewart is therefore a distributing centre for a very considerable area of good accessible prospecting-ground, and the Provincial Government is improving and extending the roads and trails each year.

Farther north the Unuk river furnishes a means of getting into the Eastern Belt, but this route is not recommended to any one who is not a good boatman, for the water is rapid and dangerous. Negotiations are now under way toward arranging co-operation between the Alaskan and Provincial Governments, which will get a trail built from tide-water at the head of Burroughs bay to the boundary-line by the Alaska Road Commission, the Province of British Columbia agreeing to continue this trail at least an equal distance and further if warranted, on the British Columbia side of the line. Such a trail would supply pack-horse transportation

and permit of the exploration of an area as large as and identical with the Salmon River valley, a few miles south on the same mineral-belt. Several parties were in the Unuk River section this summer, prospecting and reconnoitring, and all information obtainable is very favourable.

Still farther north the same belt is made accessible by the Stikine and its tributary, the Iskut river. This region is reached from Wrangell, Alaska, a port of call for all the Coast-plying boats, including a Canadian Pacific Railway boat each week. From Wrangell there is a river-boat service to the head of navigation at Telegraph Creek, the fare from Wrangell, including berth and meals, being about $25. Freight, I think, costs about 2 cents per pound from Wrangell to Telegraph Creek. The boat will stop at any place along the river and discharge freight or outfit. From Telegraph Creek there is a fair road now through to the foot of Dease lake, a distance of 72 miles. From the foot of Dease Lake to Porter Landing, a Hudson's Bay Company's post at the head, is 25 miles, from which point one can get well over the country by water routes. Altogether there is an immense prospecting area in that part of the country that is within reasonably easy transportation.

Up the Iskut there is no regular boat service, but the Barrington Transportation Company, which operates the river-boats on the Stikine, will arrange to take any one up the river about 30 miles, beyond which one would need his own boat. For any prospecting on the Stikine or Iskut river supplies would have to be obtained at Wrangell, while for the Dease Lake country supplies would be obtained at Telegraph Creek.

Navigation opens on the river about May 15th and closes about October 15th. Freight rates from Telegraph Creek to Dease lake have been, by pack-train, about 8 cents per pound, which will naturally become less as better freighting facilities are provided. There is plenty of fish and game of all kinds throughout this North country—moose, caribou, goat, birds, etc.—which prospectors are allowed to take for their own consumption. It is advisable for any one going beyond Dease lake to outfit for two seasons and remain in over the first winter in order to have two full seasons' prospecting.

The next point of access into the mineral-belt from the Coast is up the Taku river. A small gas-boat has been making trips each year from Juneau, where one would have to outfit. There is also plenty of game in this region. The Alaska Juneau Mining Company, of Juneau, did some development-work on a property in that section this summer and prospecting is increasing each year. Unfortunately no geological surveys have been made of any of the country along the mineral-belt, between Salmon river at the head of Portland canal, and the Atlin country. Consequently there are no maps and very little data for any one's information.

The Atlin section, the most northerly in the Province, is reached by way of Skagway; thence over the White Pass Railway to Carcross, and from there to Atlin by boat. This is a very accessible country; one can go for miles by automobile, and since there is very little timber and the hills not precipitous it is ideal for prospecting.

Atlin is an old placer camp and for that reason has never had the thorough prospecting for ore-deposits which its location on the Eastern Contact Belt warrants. The *Engineer* is a well-known gold property in this section, but has not been operated for years. There are several prospects that warrant some exploration, and no doubt some time in the future this portion of the district will receive merited attention in lode-mining.

The Lower Coast and islands south of Prince Rupert, and including the Queen Charlotte group, of course offer the most favourable transportation conditions of any part of the North-western District. It is an ideal country to prospect, though the geological conditions are perhaps not so favourable. However, as I have often pointed out, a low-grade ore anywhere on the Coast or islands would make a mine where a similar ore in the Interior would be valueless on account of the freighting handicap. There certainly can be no cheaper or less difficult prospecting in any country. All one needs is a boat, and what few staple supplies are needed can be procured at any of the numerous canneries, mills, and logging camps along the Coast. The prospector has no packing to do, for he need never go more than a few miles from tide-water. There has been comparatively little systematic prospecting done along the Northern Coast and Coast islands. Practically all the prospects have been located by hand-loggers, trappers, and fishermen.

I have been unable this year, owing to lack of time, to continue the work of locating and starting "prospecting-trails," on which a good start was made last year by the Mines Department. I believe this system of assistance, i.e., driving cheap trails ahead into new mineral

country by the prospectors themselves, and the present method of aiding prospectors in trail-building to their showings under the "Mines Development Act," is having a very beneficial effect in getting prospectors into the Province and keeping them in the field. I consider that the several thousand dollars granted this year by the Minister of Mines, in sums ranging from $100 to $700 or $800, as assistance to numerous claim-owners has been a great benefit and a good investment.

An idea of the number of prospectors and the amount of prospecting done in this district can be had from the fact that there are now over 2,000 claims in good standing, and this year 350 claims have been staked, compared with 700 for last year.

Development.

This I consider as the most important of the three branches of the mining industry, for although the production is looked to as the results of the year's work, the amount of development is the real indicator of the industry's progress.

A careful review of the amount of development done this year throughout this district by companies and individuals on properties not yet to the producing stage will approximate $500,000. In addition to this is the necessary development in the shipping properties.

The important feature of this year's development is the bringing-in of a new producer in the *Outsider* group at Maple bay by the Granby Company.

Shipments from the *Outsider* to the smelter at Anyox will be commenced in January and will be maintained at the rate of 100 tons a day. Adjoining properties are also under development by the same company and very satisfactory ore-bodies on the *Eagle* claim have been proven by diamond-drilling.

Equally important is the result of the year's development on the Indian Mines Corporation property up the Salmon river, which has been working steadily now for the past two years. Considerable diamond-drilling was done this fall, proving the extension of the ore-bodies at sufficient depth to leave no doubt as to the ultimate success of this enterprise.

The Dunwell Mines, Limited, Glacier creek, Bear river, has also developed ore in sufficient quantity and of a grade to justify the conclusion that another mine has been made.

The British Columbia Silver Mines property, adjoining the *Premier* on Salmon river, has also been steadily explored, and while the results have not been as satisfactory as the early work indicated, in so far as ore-bodies are concerned, yet the property may be considered as one of the promising ones in the district.

The *Big Missouri* was equipped in the spring with a compressor and work carried on all summer, but evidently the results were not up to expectations, and the plant was removed this fall and work closed down entirely.

The *Barber* mine at Atlin had some little development-work done this summer, and the chances of the property greatly improved, as depth was obtained on the vein.

The *Maid of Erin* mine in the Rainy Hollow section became involved in litigation early in the year and no work was done.

The *Engineer* mine at Atlin is also involved in litigation.

Many other properties throughout the district were under exploration during the year. These include, on Salmon river, the *Cronholm-Barthoff* claims, and Eldorado Gold Mining Company's property on the west side of Salmon glacier; the *Hercules*, *Unicorn*, and Premier Extension Mining Company on Salmon river; the Prince John Mining Company, the *Independence* group, the *L. & L.*, and the *Mobile* on Bear river; on Marmot river the *Patricia* and the *Idaho* group; the Georgia River claims on Portland canal; the *Homestake*, *Esperanza*, and others in the Alice Arm country; the *Bear* group in the Kitsumgallum Lake section; and numerous others on which work was done in excess of assessment requirements, and assessment work was done on over 1,000 claims.

Everything considered, the results of exploration and development work for the year have been satisfactory, and it is becoming more evident that, given sufficient capital judiciously and intelligently spent in mining, there will be many more mines in this district.

The trouble has been that the work on a great many properties was started on very limited capital, with the hope or expectation of finding high-grade ore similar to that on the *Premier*, and this not being immediately realized the property was closed down and more or less condemned. The future of the mining industry in this district depends on the development and mining of the milling-grade ore-bodies.

PRODUCTION.

The following is a list of the shipping properties in District No. 1 and their output for 1923:—

Name of Company.	Ore mined.	Gold.	Silver.	Copper.	Lead.
	Tons.	Oz.	Oz.	Lb.	Lb.
Granby Cons. M.S. & P. Co., Ltd., Anyox	838,301	8,056	430,147	32,950,312	.....
Esperanza, Alice arm	141	20	11,107	514	640
Premier, Stewart	145,665	117,293	2,746,551	.....	62,191
Belmont-Surf Inlet Mines, Surf Inlet	88,300	29,660	17,515	457,522	.....
United Metals, Nass	36	1	3,396	.....	7,873
Atlin Silver-Lead Mines, Atlin (Cherokee)	12	1	1,008	188	10,782
Totals for 1923 (exclusive of placer)	1,072,455	155,031	3,209,724	33,408,536	81,486
Totals for 1922 (exclusive of placer)	1,065,758	167,736	4,684,944	31,054,010	14,285
Increase	6,697	.....	.....	2,354,526	67,201
Decrease	.....	12,705	1,475,220	.....	.....

By the above figures it will be noted that there has been an increase of tonnage production of over 6,697 tons.

The gold-output is some 12,705 oz. less than last year, each of the three large producers contributing a decrease—the *Granby* by about 900 oz., the *Premier* by a little over 6,000 oz., and the *Belmont-Surf Inlet* by approximately 5,000 oz. However, it shows the substantial increase of over 70,000 oz. above two years ago.

Silver production fell off 1,475,220 oz. due to the decreased output of the *Premier* mine of 1,500,000 oz., with an increase of 44,000 oz. by *Granby:* the *Belmont-Surf Inlet* mine being practically the same as last year. This is still about double the 1921 production.

Copper has increased by about 2,500,000 lb., due to the increased output of *Granby* of that amount, though *Surf Inlet* shows a decrease of 239,000 lb. It is the greatest output of copper ever made from this or any other district in the Province in any one year.

Altogether, the metal-outputs for this district show decreases in gold and silver, but a compensating increase in copper. The grand totals give a production of $10,161,982, of which $3,204,490 is for lode gold, $1,978,153 for silver, and $4,817,510 for copper, being $614,867 less than last year, owing, in part, to serious drop in silver-output. It will be noted that the copper production is nearly half the total.

The district therefore produced 81 per cent. of the gold, 53 per cent. of the silver, and 57 per cent. of the copper, aggregating 39 per cent. of the total output of the Province for 1923, proportionately less than last year, because of the increased production of other districts.

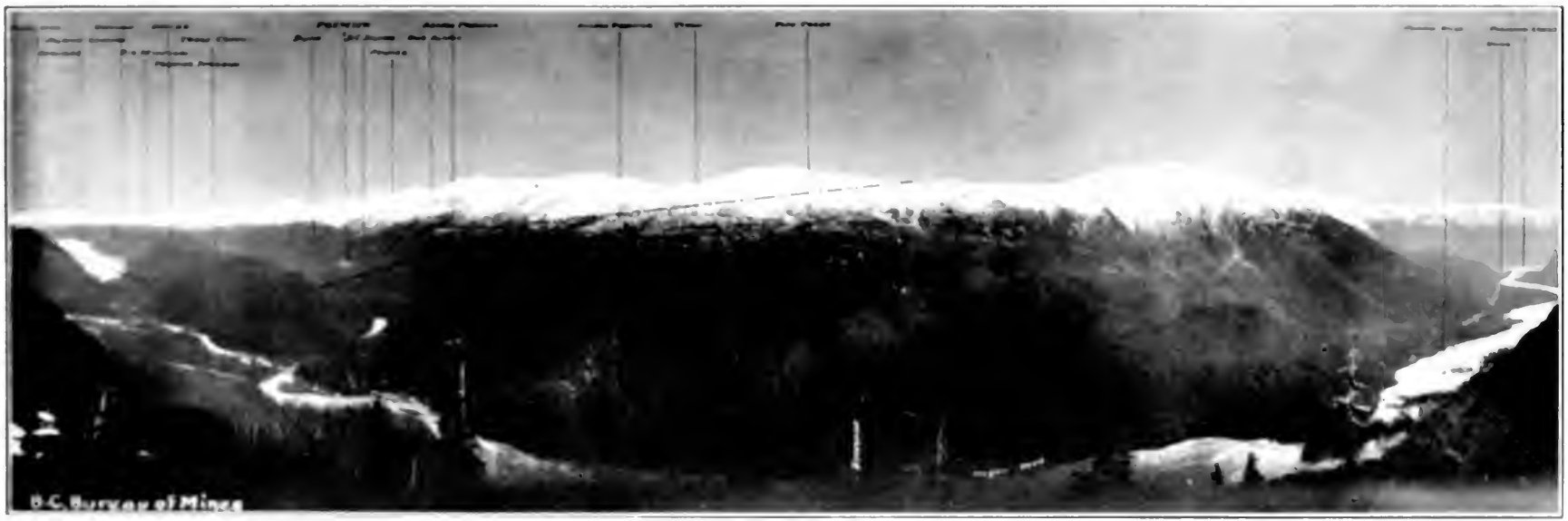
Forecasting future production, the Granby Consolidated Mining, Smelting, and Power Company, Limited, is in better shape now than ever before, with ore reserves for years; mine and smelter in good condition; adequate power plant completed; concentrator of 1,500 tons daily capacity, expected to be operating in April, 1924; and the *Outsider* mine at Maple bay furnishing a profitable flux. Under normal operating conditions her quantity production should be substantially increased, and, of course, any advance in copper prices would be doubly effective.

The Premier Gold Mining Company's decrease of 1,500,000 oz. of silver and 6,000 oz. of gold from last year is indicative of the lowering grade of the ore as depth is gained and the enriched surface ores depleted. Even so, the company paid 34 per cent. on capital this year and has now repaid 97 per cent. of capital in dividends. This property may be expected to maintain a very substantial production for some years.

The *Belmont-Surf Inlet* paid a dividend of $62,500 this year, though the production was a little under that of last year. The normal output of this property will probably be maintained for some time to come.

The *Outsider* group at Maple bay, Portland canal, is the only new property added to the shipping-list. It is under the management of the Granby Consolidated and will ship about 100 tons of siliceous copper ore a day to the smelter at Anyox.

The following properties may be considered as the most favourable-looking for future producers:—



Salmon River Valley, Portland Canal Mining Division.

The *Engineer* mine at Atlin is now being developed in a small way, but so far as actual production is concerned, seems to be an uncertain proposition on account of the continuous litigation by which the property is handicapped. Under favourable circumstances, I think it could be made a fairly important producer in a short time.

The Atlin Silver Lead Mines Company has been developing on a small scale, a suitable compressor plant having been installed this summer and a small test shipment made to the Tacoma smelter. As development proceeds, the outlook is very favourable for the property making a shipper.

The *Maid of Erin*, in the Rainy Hollow section, on which development during the past year or two had exposed a body of bornite ore, was closed down this year, pending litigation. Though handicapped with a long haulage, this property has the earmarks of developing into a shipper of high-grade copper ore.

The Indian Mines Corporation, Limited, operating the *Indian* mines on Salmon river, has this year exposed extensive bodies of milling grade ore. A concentrator has been under consideration for some time, which will no doubt make the property an important producer.

The *Big Missouri*, also on Salmon river, installed a compressor plant early in the spring and development-work was carried on until fall. The fact that the bonders of the property have made another payment gives reason for believing that development to date has been satisfactory.

The Dunwell Mines, Limited, operating on Glacier creek, Bear River valley, is opening up very promising-looking bodies of ore, giving every reason to believe that this will become one of the shipping properties within a year or two.

There are a number of others on which work has shown very encouraging results, but as yet are not sufficiently developed to indicate their importance.

Everything considered, I think it reasonably certain that several of the above-mentioned properties will fulfil the present expectations of their producing within a short time.

The district will be reviewed under the main headings of the Mining Divisions, subdivided into sections as follows:—

Queen Charlotte Mining Division—Graham Island section; Moresby Island section.
Bella Coola Mining Division.
Skeena Mining Division—Coast section; Canadian National Railway section; Kitsumgallum Valley section; Lakelse Valley section.
Nass River Mining Division—Observatory Inlet section; Hastings Arm section; Alice Arm (proper) section; Kitsault River section; Illiance River section.
Portland Canal Mining Division—Portland Canal (proper) section; Marmot River section; Bear River section; Meziadin Lake section; Salmon River section; Unuk River section.
Stikine Mining Division—Stikine River section; Iskut River section.
Liard Mining Division—Dease Lake section.
Atlin Mining Division—Taku section; Rainy Hollow section; Atlin Lake section.

QUEEN CHARLOTTE MINING DIVISION

Again there is very little progress to report in mining in this Division.

GRAHAM ISLAND SECTION.

In the spring a gold-washing plant was installed on a couple of leases on Massett Inlet, under the superintendency of P. Louat. The scheme consisted of a large pump for moving the sand and gravel from the beach to a high sluiceway on trestles providing for dumping ground into the sea. A smaller pump provided for wash-water and the whole plant looked as if it might do the work expected. Experimental work had been carried out previously and this plant adopted. The gravel had been thoroughly tested, according to Mr. Louat and the physical nature of the gravel, sand, and gold proven satisfactory for working and recovering the gold. Many pan tests also proved the values sufficient to make it a profitable undertaking, averaging, Mr. Louat stated, about 80 cents a yard. With the plant estimated to handle from 30 yards up an hour, its operation and ultimate success were assured.

I am informed that some little work was done on the Slatechuck coal areas this year. (*See* J. D. MacKenzie, Memoir 88, Geological Survey, Canada.)

No further investigations have been made of the oil-shales on the west coast or the gold-bearing black sands of the east coast of Graham island.

The investigation of the Coast and islands deposits of magnetite by the Department of Mines may have a favourable bearing on the future of the Queen Charlottes, for should the iron-deposits prove commercial the magnetite–chalcopyrite ores would then be made profitable.

South Easter Group.

This property has not been operated for the past two or three years. For the information of readers of this report the following information is submitted: The property, as it now stands, consists of seven claims—namely, *South Easter*, *Triangle Fraction*, *Lion*, *Blue Jay*, *North Bay*, *Cobalt*, and *Toronto*—owned by McLellan, Gordon (of Queen Charlotte City), *et al.* The claims are situated about a mile from the beach at Skidegate, from which there is a good wagon-road to the camp.

The showing consists of a quartz vein from 8 to 10 feet in width, in a diabasic country-rock, mineralized with pyrite carrying gold values, about 40 per cent. of which is free-milling. The vein has been traced on the surface for upwards of 1,000 feet in places, giving average values of $12 to $15 a ton across it. Some very fine ore was sorted out of the ore taken from the shaft and specimens showing splashes of mustard gold were frequently found. The vein was explored by a shaft sunk 100 feet, from which, at the 50-foot level, drifts were run 50 feet to the west and 75 feet to the east; and the 100-foot level, 100 feet to the west and 250 feet to the east.

In the 50-foot level east drift there is a good shoot of ore, but the lower drifts show only a broken-up, mud-filled vein. It would therefore appear as if the ore-shoot extended from the surface to a depth of about 65 feet and averages about 5 feet in width. The property is equipped with a good camp; a 200-cubic-foot Chicago Pneumatic Drill Company compressor of semi-Diesel type, consuming about 30 gallons fuel-oil in eight hours. One-man Denver "Clipper" machines were used in development.

The very favourable situation of the property, the surface indications, and the ore-shoot exposed in the workings would seem to justify further development in the hope of exposing a milling-grade ore-body.

Moresby Island Section.

Early Bird Group.

This property is situated on the west coast in Gold harbour and is owned by J. G. McLellan, of Queen Charlotte City. The property produced the first free gold found on Queen Charlotte islands, mined by the Hudson's Bay Company. The owner put up a 2-stamp mill on the property and did considerable exploratory work. The ore, sorted to about a $40 mill-feed, about paid expenses. No more lenses of high-grade free gold were found, and after a couple of attempts at leasing, which proved unprofitable, nothing has been done on the property for the past two years.

Blue Mule Group.

This group consists of the *Blue Mule*, *Paystreak No. 1*, and *Paystreak No. 2*, owned by Wiggs & McRae, of Skidegate, and under bond this year to Nels Larsen, who installed a Ross mill, necessitating the building of a 100-foot flume and making a 14½-foot water-wheel, with 8-foot drive-pulley, countershaft and pulleys, and four ore-bins, all under roof and all built with an axe. The ore is mined from an open-cut on the vein and wheeled in a wheelbarrow about 75 feet and dumped into another cut, from which it is loaded and wheeled 200 feet to first ore-bin.

It is drawn from this bin and crushed by hand by spring-pole and pig-iron weight to less than 1-inch size before it goes to the 4 by 6 jaw-crusher which forms a part of the Ross mill equipment. This equipment was only capable of reducing 1 ton of this ore in twenty-four hours to a fineness to free the gold.

While the principle of the mill apparently may be good, the material used in its construction was of such poor quality as to render the mill of little value for use in isolated places, where new parts for the machine cannot be procured.

Larsen has done a great deal of very hard work and it is a pity that he should be handicapped by such an inefficient mill.

This property would yield a nice little profit from the surface ores if a capacity of 5 tons a day could be attained in the mill.

The ore showing in the cut appears to pinch out at about a depth of 10 feet from the surface. There are three veins on the claims, the upper one being the largest and has had the most exploration-work done on it. The formation is an andesitic-looking rock in which are parallel

shear-zones filled with a breccia of quartz and country-rock, varying in proportion from straight quartz to country-rock, in which there are only quartz stringers and all more or less pyritized. The values are in gold, partly in the pyrite and partly as free gold in the quartz and pyrite. With a dependable mill this little property might be operated and sufficient profit made to further develop it.

It is reached from Queen Charlotte City by boat, and I would suggest, from experience, that a good-sized boat run by a white man be procured and sufficient supplies to last at least a week be taken, for one is liable to be storm-bound for several days at a time.

Homestake Group. Several inquiries have been had this season regarding this property and a brief description of it may be of assistance. It is one of the old properties on the islands, staked in 1907 on the north shore of Cumshewa Inlet, and was owned by the Queen Charlotte Island General Development Company, Limited, in 1913. The original group consisted of the *Homestake*, *Go East No. 1*, and *Boulder* claims. The following description of the property is excerpted from the Minister of Mines' Report, 1913, when D. G. Forbes reported on it; since then no work has been done:—

"The property is situated on the north side of the inlet at an elevation of 240 feet and half a mile from salt water. The ledges worked lie in a shattered zone of slate, situated between slate on the south and siliceous limestone on the north; the gangue is quartz and calcite and the mineralization pyrite, zinc-blende, and a little galena. A tunnel has been driven on the shattered zone for a distance of 305 feet, from which point two quartz ledges have been exposed. The northerly one, known as the *Homestake* ledge, has been followed for 230 feet, the fissure being 5 feet in width and nearly vertical; this is sometimes filled with barren-looking quartz, but often only contains vein-filling, consisting of a little quartz mixed with country-rock. A sample of the quartz from this level gave only traces of gold and silver. The south ledge, known as the *Go East* ledge, has been followed for 425 feet and dips at 78° to the north west; the fissure has a width of 5 feet and is filled with quartzite, quartz, and vein-filling. The ore in both ledges is low grade generally, except when it contains galena, when the gold values often run up to over $100 to the ton; unfortunately, galena is not plentiful in the ledge. A sample assayed 0.03 oz. gold. A winze has been sunk 35 feet on the best of the ore on the foot-wall side of the *Go East* ledge; the winze shows from 12 to 18 inches of fairly well-mineralized quartz, occasionally showing some free gold. A sample assayed 0.4 oz. gold and 6.6 oz. silver.

"At the end of the drift on the *Go East* ledge a crosscut has been driven to the north, cutting the *Homestake* ledge, which at this point is only a few inches in thickness, and this crosscut has been extended for some distance into the siliceous limestone on the north side of the ledge; the total length of the crosscut is 280 feet.

"A crosscut has also been driven south from the *Go East* ledge a distance of 155 feet in slate; several other short crosscuts have been driven as the work proceeded, both to the north and south, but they have disclosed little of value. On the *Homestake* ledge, 65 feet above the main tunnel, a tunnel has been driven 117 feet, but does not look promising. Owing to the broken nature of the rock in the lower tunnel it has been necessary to close-timber the levels, and consequently the greater part of the ledges opened up could not be seen.

"Development-work consists of 1,206 feet of drifting, 610 feet of crosscuts, and 280 feet of winzes; in all, 2,096 feet of work. Five men were employed at the time of my visit.

"Some shipments of ore have been made to the smelters from this property, but they do not represent the average values of the ore, as it was closely hand-picked before shipping."

Swede Group. This old group of eight claims is situated just outside of Lockeport Harbour and is still owned by the original stakers, Rogers, Pearson & Larsen, of Lockeport. The claims contain an immense deposit of low-grade copper ore, consisting of chalcopyrite and bornite, disseminated, and in small veinlets in a diabase country-rock. The bornite carries a small value in platinum. Nothing further than assessment-work has been done on the property for several years. It is ideally situated for working on any scale.

Shuttle Island.—Some work was done on this property by the owners during the summer, but nothing of importance has been reported. The showings are small quartz veins in a sedimentary formation, carrying free gold. About 150 feet of drifting has been done on these veins, but they are small and the average values are not sufficient to make it a very profitable undertaking. The island is low and no great depth can be obtained without sinking.

Around Jedway there are several properties on which the annual assessment is kept up by the owners. These include the *Copper Queen* group, owned by J. S. McMillan, and situated just above Jedway harbour. Several years ago considerable prospecting and development work was done on the low-grade magnetite-copper showings on this property and a tramway right-of-way cut down to the head of the harbour. Since then work has been of a desultory nature to fulfil the requirements for assessments. Several examinations have been made of the property, but nothing in the way of operating has resulted.

Copper Island.—A. Heino, of Jedway, has owned these claims a number of years and done a considerable amount of work on them, shipping small tonnages of good-grade copper ore occasionally. There are three claims—*Golden Gate*, *Trust*, and *Skincuttle Entrance*—covering the island. The gangue rock consists of a broad belt of hornblende about 1,400 feet long, showing chalcopyrite in disseminated grains and bunches, wherever broken into, across a width of from 20 to 30 feet. On the foot-wall of the hornblende-belt is silicified limestone, also mineralized with chalcopyrite. A tunnel has been driven in this over 150 feet, disclosing some good ore, from which Mr. Heino has sorted what he has shipped. A depth of about 200 feet can be obtained without sinking. Everything considered, this showing is worth investigating if satisfactory terms can be had on the property.

Campbell Island.—This island, adjoining Copper island, at the entrance to Jedway, has some claims on it belonging to W. Campbell, who works on the hornblende-chalcopyrite showing whenever he has the means. The island is heavily overburdened and low, necessitating sinking on the showings when found.

Ikeda Mines, Ltd. This property, situated on Ikeda bay, south of Jedway, was a steady shipper of copper ore for a number of years, under the management of A. Ikeda, but in 1920 the small vein of good ore was exhausted and the property closed down. Since that time it has been the aim of the owners to get development started on some of the lower-grade ore-showings, believing that a sufficient tonnage of milling-grade ore could be developed, in addition to what is already on the dump and exposed in the old workings, to justify the installation of a concentrator. However, nothing as yet has been done on the property.

Hope Group.—Situated at head of Huston inlet. Only yearly assessment has been done.

Thunder Group.—Situated on Collison bay. Nothing of importance has been done on this property for two or three years.

Meal Ticket Group. This group, situated on Collison bay, lies just south of the *Thunder* group and about three-quarters of a mile from the beach. There are three claims in the group—*Meal Ticket*, *Treasure Vault*, and *Treasure Box*—owned by George D. Scott, of Vancouver. The country-rock is diorite. The showing consists of an 8-foot vein of magnetite carrying considerable pyrrhotite and some pyrite and chalcopyrite. The vein has been stripped and exposed on the surface for a couple of hundred feet and a few shots put in here and there, showing some shipping-grade copper ore. In fact, the surface showing is promising and a little work might open up a profitable ore-body.

Farther south on the vein a crosscut tunnel about 30 feet long cuts the vein, showing it to be about 8 feet wide, but not so well mineralized as other parts of the croppings. This tunnel is about 275 feet elevation and I estimate an additional 100 or 150 feet depth could be obtained by crosscutting from the creek-bed lower down, giving a good grade to the beach. This property justifies some further exploration.

There are several large magnetite-showings in this vicinity, carrying about 1 to 1.5 per cent. copper, that might warrant consideration should the steel industry ever become a fact on the British Columbia Coast.

BELLA COOLA MINING DIVISION.

I did not get into the Bella Coola Division this year and my information is very limited as to mining progress. Assistance was recommended and granted to the owners of the *Saloomt* group, reported in last year's Minister of Mines' Report, for the improvement of the trail from the Bella Coola Valley wagon-road to the property. I do not know whether anything was done on the trail or property this year.

There were some stakings and assessments done on claims previously staked on Tesla mountain, presumably at the headwaters of the Bella Coola river.

Percy Gadsten, of Bella Coola, staked twelve or thirteen claims on Tesla mountain this season, and claims to have partially cut a trail through from Tesla lake to the Kimsquit, a distance of 40 miles.

V. Dolmage, in his report* on the Coast and Islands, between Burke and Douglas channels, cites only one occurrence of mineral in the Bella Coola Division; i.e., magnetite iron on Burke channel.

SKEENA MINING DIVISION.

This Division has had about a normal year so far as mining is concerned. Its one producing property, the *Belmont-Surf Inlet* mine at Surf Inlet, Princess Royal Island, has been operating steadily throughout the year. There have been possibly more prospectors on the Coast this year, but no new discoveries of any note are reported. The *Dunn Lammon* mine was closed in May and has not been reopened. The outstanding feature was the option held by the Granby Company on the Eestall River property. It was rumoured for some time that results of diamond-drilling ensured the taking-over of the option, but nevertheless all equipment was withdrawn from the property and the option thrown up. Different smaller properties on the Coast and Islands had more or less work done on them, and there was some activity in the Kitsumgallum Lake section.

About 110 claims have been recorded in this Division this year, making approximately 290 claims in good standing at the end of 1923.

COAST SECTION.†

This includes all the Coast Islands and the mainland on tide-water for a distance of about 200 miles south from the Alaskan boundary.

Belmont-Surf Inlet Mines, Ltd.

(*See* previous Annual Reports.) The company's mining holdings are situated 7 miles up from the head of Surf Inlet, on the west coast of Princess Royal Island. This property has been continuously operated since the fall of 1916, during which time it has mined and milled approximately 670,000 tons of ore, yielding about 240,000 oz. gold, 135,000 oz. silver, and 4,000,000 lb. copper. This year there were mined and milled 88,300 tons of ore, which produced 6,324 tons of concentrates, a ratio of concentration of between 12 and 13 into 1. The metal returns from this tonnage were 29,020 oz. gold, 17,515 oz. silver, and 457,522 lb. copper, each a little less than last year. The major portion of the ore came from the *Surf Inlet* property, though the *Pugsley* furnished a considerably greater tonnage than last year.

The main shaft in the *Surf Inlet* has been sunk to the 1,270-foot level, which is now being explored. This is 150 feet below sea-level. The main 1,000-foot level tunnel being driven from the surface has not yet reached its objective. Altogether, there were 6,735 feet of development-work done this year, segregated into 3,872 feet of drifting, 783 feet of crosscutting, 50 feet of winzes, 1,842 feet of raises, and 208 feet of shafts.

A considerable tonnage of ore was won from the old stopes in the upper levels in taking out floors, drawing pillars, etc. A dividend of 2½ per cent., amounting to $62,500, was paid on October 15th, making a total of dividends paid of $687,500.

The personnel of the management at the mine remains the same as last year, consisting of F. H. Penn, general superintendent; E. Hawkins, auditor; P. W. Racey, mine superintendent; and Fred Collins, mine foreman.

Cordilla Group.

(*See* last year's report.) This group is comprised of six claims—*Royal*, *Right*, *Landslide*, *Mountain View*, *Counder*, and *Present*—owned by Cordilla & Koskt. Hearing that the owners had cleared out the tunnel this year, I again visited the property and was able to get within a short distance of the face. As described in last year's report, the showing consists of small lenses of pyritized quartz lying in a shear zone in the granodiorite country-rock, similar to *Surf Inlet*. So far as can be seen on the surface and in the 300-foot tunnel, the quartz-lenses are too small and values too low to be of any importance.

Nothing was done on the *Gold Bug* group on Pitt Island this year. There is a well-pyritized, well-defined quartz vein on this property and gold values found on the surface warrant additional work. It is a *Surf Inlet* type of vein.

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* Summary Report, Geological Survey, Canada, 1921, Part A.

† V. Dolmage, Summary Reports, Geological Survey, Canada, 1921 and 1922, Part A.

Bolton Group. (*See* last year's report.) Some work has been done on this property this year. Trail improvements were noted, but nothing had been done at the upper (old) showings, so concluded that surface prospecting had been done in tracing the vein down the hill.

Crawford Claims. This is the old *Plattenberger* group of claims about 2 miles north of Swanson bay on the mainland. There have been six claims—*Millbank*, *Clawhammer*, *Pic*, *Golden Ore*, *Big Slide*, and *Slide Two*—staked by E. H. Crawford, covering the old ground and showings. Considerable surface work had been done previously on these claims and a crosscut tunnel driven 160 feet toward cutting the vein.

The showing is a pyritized quartz vein from 6 to 12 feet wide, in schist formation, at about 600 feet elevation and traceable on the surface for over 1,000 feet. Only low values have been obtainable on the surface, but the present owners propose extending the present tunnel 135 feet to cut the vein at depth of nearly 300 feet below the surface. Some drifting will then be done on the vein. This work will be done this winter and should decide whether it is worth further exploration.

Drum Lummon Mines, Ltd. (*See* previous reports.) The property was closed down in May of this year owing to financial difficulties and had not resumed operations at the end of the year. The property is well equipped; very little development of ore, however, has been done. Last year a pile dock 32 by 50 feet and an approach of 1,000 feet were built, with a substantial warehouse on the dock. A railway 3,600 feet long was built from the dock to the ore-bunker at the foot of the tramway, with a 2-ton Ford truck. The tram is of the "jig-back" type, 2,100 feet long, with buckets of 15 cubic feet capacity, loaded from good bunkers at the head. There is a fine power plant, consisting of 120-horse-power full Diesel engine and a 500-cubic-foot compressor; altogether a very creditable and efficient equipment.

Ecstall River.—The immense deposit of pyrite about 25 miles up the Ecstall river, a tributary of the Skeena, joining it at Port Essington, was further explored by the Granby Company this year by diamond-drilling. This is the second option on this property by the Granby Company, and it was sincerely hoped that their exploratory work would prove conclusively satisfactory and justify its acquirement and operation. Apparently the results of the work were disappointing, as all the equipment was withdrawn and the property reverted to the Victoria owners.

Patterson Group. This property, situated on the north end of Porcher island, has been worked in a small way nearly all year. Assistance toward building a trail over which ore can be shipped was recommended to and granted by the Mines Department. The owners have been mining and sorting ore steadily for the past five months, and now, the end of the year, are getting a small shipment down to the beach. The property is looking very encouraging and the prospects of getting out further shipments from now on are good.

There are several veins similar to this in this vicinity which I believe warrant a little development-work and which will ultimately make profitable small producers.

Only necessary assessments have been done this year on adjoining groups.

CANADIAN NATIONAL RAILWAY SECTION.

This section takes in all the country contiguous to the railway, from Prince Rupert to Terrace, a distance of 95 miles. Of this, from the Coast, about 20 miles consists of crystalline schists, termed by McConnell the "Prince Rupert formation," the balance being the main granodiorite batholith. A great many claims were staked in the early river-boat days along the Skeena river, and at that time regular assessment-work was done every year. In the last few years, however, very few of these claims have been kept in good standing.

Autumn Group. This group is situated a short distance west of Amsbury and is owned by Sam Alger. There are five claims in the group—*Autumn No. 1*, *Autumn No. 2*, *Happy*, *Wellington*, and *Lottie*. Mr. Alger has done a great deal of work on these claims and I regret that I have not been able to get up to them yet.

KITSUMGALLUM VALLEY SECTION.

This area lies along the Eastern Contact Belt; that is, the same belt extending through to Alice arm, Stewart, and north to the Atlin country. From Terrace, on the Canadian National

Railway, north to Kitsumgallum lake, a distance of 20 miles, but little prospecting has been done on either side of the valley, which is, on the east side, all granodiorite to about half way up Kitsumgallum lake. From there north is mainly shales, argillites, quartzites, and conglomerates, with masses of granite through to the Nass river and beyond this to Alice arm. (*See* Geo. Hanson, Summary Report, 1922, Part A.)

There has been considerable prospecting and staking in the immediate vicinity of Kitsumgallum lake this year. The road from Terrace to the lake has been greatly improved and relocated so that an auto can now get within a couple of miles of the lower lake. This has, of course, been a great aid in getting in supplies and consequently prospecting has increased. The oil boom seems to have evaporated.

Bear Group. The four claims in this group—*Hauck*, *Whistler*, *Goat*, and *Bear*—are situated at the head of the North fork of Hall creek. They were originally staked and owned by Matt Allard, of Terrace, and partners, but have been under bond for the past two years to Seattle interests, under O. P. Brown. Very little was done last year, and that of an unsatisfactory nature to all concerned. This year, under the superintendency of W. R. Owings, some further development-work was done on the vein and tests made of the ore with a Ross mill plant. A good cook-house was built and tents put up for sleeping accommodation at 4,200 feet elevation.

The testing plant at the same elevation consists of a small jig-back tramway from the workings to the mill, a small jaw-crusher, a Ross mill, and small table of the Wilfley type. The crusher is driven by a 5-horse-power gas engine, which runs the Ross mill when not crushing.

The ore is delivered to a bin from the tramway; thence to the crusher, which delivers a ¼-inch product direct to the mill. From the mill the ground product is fed to the Wilfley, which makes two products, a pyrite concentrate and a galena concentrate. The table is driven by a 2-horse-power gas engine, which also operates a small centrifugal pump supplying water to the Ross mill.

A considerable proportion of the gold values are recoverable by amalgamation. Two products can be made, if desired—a fairly clean galena-pyrite concentrate, assaying about 60 per cent lead, which will carry about $200 a ton in gold values, and an iron sulphide concentrate that will run about $75 a ton; or an all-sulphide product which would run well over $100 a ton in gold. There were at the mill about fifty sacks of concentrates which was a good clean sulphide product.

The open-cuts on the surface were deepened; a shaft sunk about 10 feet on the vein, showing from 2 to 3 feet of vein in the bottom, consisting of from 10 to 12 inches on the hanging wall and 6 to 10 inches on the foot wall, of heavy sulphides, pyrite galena, and zinc blende. Another shallow shaft about 20 feet north of this shows about 8 feet of good ore, and an open cut just north of this exposes from 1 to 3 feet of good ore.

A 20-foot crosscut tunnel was driven in to the vein, getting a depth of about 15 feet on it, the ore here showing about 3 feet wide of good galena.

I am informed that the mill tests were very satisfactory. Such being the case, the property should be opened up by a crosscut tunnel from just above the camp, which will reach the vein in less than 150 feet and obtain over 100 feet of depth on it. Drifts can then be run both ways and if sufficient ore is exposed a suitable mill can be planned, to be installed down on Hall creek, about 1,000 feet below the vein-croppings, where there is plenty of water for milling and power.

Also from such mill-site a wagon or truck road could be built on a good grade down Hall creek for transportation of ore to the head of the lake. I expect this will make a profitable small property when properly opened up and operated.

Gold Cap. This claim, owned by James Cauthers, of Terrace, adjoins the *Black Bear* group on the north, toward the head of Hall creek or Falls creek. The *Bear* group vein evidently faults to the west in a small gulch, but has been picked up north of the fault and traced the length of this claim and for 2 miles farther across the head of Falls creek. The vein has here been exposed for 100 feet by stripping and open-cutting, showing a few inches in width of decomposed vein material similar to the cropping on the *Bear* group.

Black Wolf Group. This group consists of three claims—*Black Wolf No. 1*, *Black Wolf No. 2*, and *Black Wolf No. 3*—owned by Gendron, Couture, Brodin, and Olander, of Terrace. This group, adjoining the *Black Bear* group on the south, is located along the *Black Bear* vein, making its traced length about 4 miles. Only assessment-work was done on the group this year.

Motherlode Group. The four claims in this group—*Motherlode*, *New York*, *B.C.*, and *Rainbow*—are owned by the original locators, Oscar Gendron, Paul Brodin, Oscar Olander, and John Couture. The claims are at the head of Falls or Hall creek; the camp at 5,200 feet elevation. The owners have done a lot of work on this group on the strength of heavy float of silver-bearing ore found along the slide-rock. Two tunnels have been driven; the lower one, 150 feet above the cabin, is in 140 feet, and the upper one, 350 feet above the cabin, has been driven 60 feet.

On examination of the bluffs and the ridge of the mountain above the tunnel, and the east slope of the mountain down towards Maroon creek, I found that the andesite or diorite belt in which the tunnels have been driven overlies the schists seen on the Maroon side. The float on the west or tunnel-site could not therefore have been thrown from any outcrop on the east side.

Also there are no schist-bands of any note in the diorite-belt on the top from which the float could be derived. I therefore conclude that the ore which occurs in schist and found as float on the west side originated from a flat schist-belt overlying the diorite, which has been eroded and broken up and mingled with the slide-rock.

As no ore has been found east of the diorite, it would be useless to drive through that belt in the hope of encountering any. The only hope of finding ore in-place would be north or south along the west slope of the diorite, where the overlying schists have not been eroded.

Sunlight Group. This group of two claims—*Sunlight* and *Marmot*—owned by A. Egan and A. McKinnon, is situated on Goat mountain, on the opposite side of Hall creek from the *Bear* group. It is reached by a branch trail going up the North fork of Hall creek. The rock formation is a banded siliceous slate striking N. 80° E. and dipping about 30° N. The vein is quartz varying in width up to 12 feet and conforms with the strike and dip of the country-rock. It shows on the surface for several hundred feet and is sparingly mineralized with pyrites and chalcopyrite, a seam on the hanging-wall of the shaft showing a few inches of zinc-blende and galena. The owners have done considerable work on the property since I have examined it and report a satisfactory improvement.

Scenic Group. This group of two claims up Maroon creek, belonging to John Garland, of Terrace, was described in last year's report. While I did not visit the property this year, I understand that the owner has opened up an encouraging showing of chalcopyrite above his cabin, and has improved the showing in the dyke just over the divide on the Skeena slope.

Nothing was done this year on the *Lucy O'Neil*, also up Maroon creek, except assessment-work.

The *Blue Grouse* group, *Hunter* group, and *Relief* claim, all on Cedar creek, owned by O. Wickstrom, O. Olander, and A. Egan respectively, have had no work other than the necessary yearly assessment.

On Douglas creek, an old placer creek flowing in at the head of Kitsumgallum lake, on which they were placer-mining fifty years ago, a number of leases have been recorded.

D. R. Shaw and associates have four, extending up the creek from about half a mile from the lake, and there are two or more above that. Shaw has done some little work this season in building a trail up the creek to his upper lease, as well as stripping and rocking an appreciable amount of bed-rock on his lower lease, from which he claims to have made about 50 cents an hour. It is his intention to carry a bed-rock drain up the creek, so that he can confine the water to one channel and permit of washing the balance of bed-rock.

Portland Group. This group now consists of four claims—*Portland*, *Portland Heights*, *North Portland*, and *West Portland*—and in last year's report was called the Portland Mining Company. The claims are situated on the west side of Kitsumgallum lake, from the lake up the hill, and owned by C. A. Smith, of Terrace. The country rock is granodiorite. The showing is a pyritized quartz vein carrying a little chalcopyrite, in which free gold can be seen. Some beautiful specimens have been obtained. A shaft has been sunk 30 feet on this vein, which will average about a foot wide, and a 5-foot drift driven from the bottom of

Granby C. M. S. & P. Co., Anyox—Mine Camp.

Anyox Smelter—Copper on Dock

the shaft. It was about half-full of water when I was on the property. Additional claims have been staked up the hill on the strike of the vein, and some work done toward trying to locate the vein on the side-hill, where it could be more easily opened up, but as yet without success. It is a nice little showing and can probably be worked on a small scale at a profit.

On the opposite side of the lake George Cobb has done some stripping and open-cutting on the *Jenny Jiggs* claim.

Up Little Beaver river, on Little Beaver mountain, William Treston and partner have done assessments on the two groups of claims—*Marten* group and *Mayo Boy* group.

On the *Adair* and *Juneau* claims, on the east side of the lake, some work was done by the owner, J. Belway.

Assessment-work was done on the *Oakwood* group, just east of Terrace, by E. Hainer, the owner.

Golden Nib. This is the old *Iron Hat* claim, now owned by Wm. Dahl and under bond to O. P. Brown, who has done some work on it this fall. The vein is quartz in a country rock of argillite. The croppings show a vein width up to 4 feet, heavily mineralized in places with pyrrhotite, where the gold values will run up to $40 to $50. A tunnel had been driven 80 feet on this vein to get under the surface values, when Mr. Brown took a bond on the claim.

He has continued the tunnel to 94 feet to the end of the year, and reports 8 feet in width of quartz, in the face of which about 30 inches is fairly well mineralized with iron sulphides, the balance being barren quartz.

Mr. Brown intends putting in a small compressor right away to run a jack-hammer and do sufficient work to prove whether it can be made a profitable mine or not.

The *Silver Dollar* group of two claims on the Telegraph trail, about 3 miles west of Cedar River Crossing, had some work done on it last winter by the owners, Jack Couture and partners.

LAKELSE VALLEY SECTION.

I did not get over this section this year.

Assessments have been done on the following: *Golden Penny* claim, at head of Eliza creek, by E. Hault; *Ptarmigan* group, on Thornhill mountain, by the Michaud Bros. *Society Girl* group, on Thornhill mountain, by Bell & Mason; *Beaver* group, on slope of Thornhill mountain, by Wm. Dahl; *New Find* and *Copper Queen* claims, on Williams creek, by J. H. Bell (a good trail was built up this creek this summer by the Mines Department); *Surprise* group, on Williams creek, by R. H. Eaton; *Lakelse* group, at 8-Mile post, Lakelse road, by T. M. Turner.

I am informed that O. P. Brown, who has a bond on the *Bear* group at Kitsumgallum lake, has also bonded the *Beaver* group on Thornhill mountain, which consists of the four claims, *Golden Lady, Star, Fisher*, and *Beaver*. This was the old *Lucky Seven* group, owned by the late A. Olsson, but since restaked by William Dahl. Mr. Brown is figuring on a small mill to be located at the foot of the hill, about three-quarters of a mile from the Lakelse wagon road. All the ores from the different veins on the *Beaver* group, as well as the *Golden Nib* ore, can be treated in this mill.

NASS RIVER MINING DIVISION.

This Division extends from the mouth of Portland Inlet north to the head of the Kitsault river, a distance of about 70 miles. The two chief mining centres are Anyox and Alice Arm, the Government offices being at the former. These towns are ports of call for the Canadian National ships once a week, and the Union Steamship boats also once a week. There is a tri-weekly launch service between Anyox and Alice Arm. Alice Arm is the distributing point for the Kitsault River valley and its tributaries, the Illiance river, and down Alice arm.

The Dolly Varden Railway runs from Alice Arm up the Kitsault river 18 miles to the *Dolly Varden* mine. The railway has been maintained for hand-cars and speeders by the Provincial Government for the past two or three years while the mine has been non-operative. From the end of rail there is a good pack-horse trail to the head of the valley, with branches up Trout creek, Clearwater creek, and to the *Vanguard* and other properties. Also there is a first class pack-horse trail up the Illiance for 16 miles, built by the Mines Department, and a fair foot-trail up Lime and Roundy creeks, emptying in on the north-east side of the arm.

One can go up the Nass river from Mill Bay Cannery at its mouth, and a port of call once a week for Union Steamship Company boats, from which point a mail launch runs once a week

to Aiyansh. From Aiyansh there are roads through the Nass valley; a trail up the Nass river to Meziadin lake; a trail across to the Illiance river; and another south to the Kitsumgallum valley to Terrace, on the Canadian National Railway. From the head of Hastings arm a trail is being built up to the mineral-belt, a distance of 12 miles. The Division is therefore well supplied with means of transportation and very accessible for prospecting or mining development.

A preliminary survey has been made for the Geological Survey of Canada by George Hanson.*

For the geology of this area *see* the accompanying map by Geo. Hanson. From this it will be seen that the Kitsault River formation, composed of argillites and argillaceous quartzites, extends through from Alice arm to within a short distance of the Nass river, following the Telegraph trail. Judging from the mineral-showings in this formation up the Kitsault river, it is a favourable field for prospecting, excepting, of course, from the transportation end of it. From the Nass river south to the head of Kitsumgallum lake the formation changes to shales, argillites, sandstones, etc., and is not as likely a formation for ore-deposits.

There is in this Mining Division the one large producer, the Granby Consolidated at Anyox, which has the largest output of copper in the Province. Heretofore there have been several small shippers, but the only one this year is the *Esperanza* at Alice arm and the United Metals Company, which shipped a few tons of ore mined up the Illiance two or three years ago.

There are a number of very promising surface showings in Kitsault Valley and Illiance River sections, and all that locality needs is sufficient capital and capable mining. A very informative geological report was issued by the Geological Survey of Canada, 1921, covering this area.†

Much prospecting and development was done throughout the year by prospectors and individual owners, the Homestake Mining and Development Company, Limited, being the only company operating. It is hoped that the *Dolly Varden* will resume operations in the spring.

The following trails were built by the Mines Department in this Division this year: Hastings arm, a prospector's trail from tide-water at the head of the arm up O'Neil river for 12 miles; Kitsault River trail from Trout creek through to the *Homestake* mine, about 7,000 feet new trail and the balance repaired. Roundy Creek trail, repairs from the beach to the Keystone Mining Company's holdings.

Observatory Inlet Section.

Granby C.M.S. & P. Co.

(*See* previous reports.) This company has been operating steadily ever since the smelter was "blown in" in 1914, or practically ten years. During that time the output totals were as follows: Gold, 59,197 oz.; silver, 3,041,004 oz.; copper, 256,431,774 lb. This has probably been the company's most aggressive and progressive year since it started operations, although costs have naturally been high, due to wages, new installations, replacements of old equipment, etc.

The year's output of 838,301 tons mined and smelted, yielding 8,056 oz. gold, 430,147 oz. silver, and 32,950,312 lb. copper, is outstanding as the greatest ever obtained from the company's *Hidden Creek* mines in one year, with the exception of 1921, notwithstanding the loss of a considerable number of smelting-days due to fires, floods, etc. In addition to the above tonnage, there were also mined 25,590 tons of fluxing-quartz, carrying no values.

The coke plant produced 55,532 short tons of coke; 548,574 imperial gallons of tar; 878,192 lb. of ammonium sulphate; 210,420 lb. of concentrated ammonia liquor; and 152,033 imperial gallons of motor-fuel.

The company is mining and smelting an average of about 3,000 tons of heavy pyritic copper ore a day, employing an average of 1,100 men throughout the year.

It is estimated that so far 13,000,000 tons of ore, of an average content of 2.15 per cent. copper, has been developed in the seven ore-bodies opened up in the mine. The ore-bodies are, according to Dolmage, found on and near the contact of metamorphosed argillites and intrusive greenstone, which form an inclusion in the Coast Range batholith of about 9 miles in width, the argillite-greenstone contact, and therefore the ore-bodies, lying about the centre of the inclusion. The greenstones lie to the west and extend to Portland canal and beyond.

There are two types of ore-deposits, the one consisting of a series of lenses of heavy pyrite lying along the contact, and the other consisting of pyrrhotite and chalcopyrite occupying shear-

* *See* Summary Report, 1922, Part A.

† Upper Kitsault Valley, Summary Report, 1921, Part A, by Geo. Hanson.

zones and joint planes in the greenstones. The first type furnishes the present smelting ore, and a concentrator is now under construction for the concentration of ores of the second type to the sulphides, eliminating the unsmeltable greenstone.

The following excerpt from Dolmage's report* is descriptive of these ore-bodies: "Nos. 1 to 5 are clustered close together about the apex of a spur of greenstone about 2,500 feet square, which juts out into the argillites in a north-east direction. The sixth ore-body lies 1,200 feet to the south-west on the south-east side of the above-mentioned spur of greenstone. Another ore-body, which is really a separate deposit, but is owned by the same company and known as the Bonanza, is situated 3½ miles to the south on Bonanza creek and 3,200 feet from the shore of Granby bay. This deposit is also on a contact between the argillites and a small mass of greenstone less than a mile in diameter.

"Ore-bodies Nos. 1, 4, 5, and 6 lie on the contact of the argillites and greenstones, where the argillites are much crumpled and the greenstones are especially schistose. Nos. 1 and 5 have developed where the turn in the strike of the greenstone-argillite contact is most abrupt. These ore-bodies are richer where the slate contact overhangs the ore. Ore-bodies Nos. 2 and 3 and Bonanza lie in the greenstone, where it is especially schistose, and Nos. 2 and 3 are so situated that at the time of their deposition they were probably roofed by slate.

"The following dimensions will give some idea of the sizes of the ore-bodies: Ore-bodies Nos. 1 and 5 have a combined length on the 530-foot level of about 1,240 feet, with an average width of 150 feet. No. 3 is a faulted block of No. 2 and they have a combined length of 770 feet, with a width of 240 feet. No. 4 ore-body lies chiefly above the 530-foot level. It is triangular in plan, with a length on the 760-foot level of 500 feet. The present workings extend over a vertical range of 800 feet and diamond-drilling has proved the ore-bodies to extend still deeper. They have a maximum size in cross-section on the 530-foot level, below which there is a gradual decrease in size, which becomes more marked below the 150-foot level and is coincident with a sudden flattening of the greenstone-argillite contact.

"There has been developed up to date in ore-bodies Nos. 1, 2, 3, 4, 5, 6, and 7, 13,215,000 tons of high-grade ore averaging 2.14 per cent. copper, and 1,331,000 tons of low grade ore carrying 0.94 per cent. copper. The Bonanza deposit contains 488,800 tons of 2.49-per-cent. ore and 577,200 tons of 0.64-per-cent. ore."

The mine has been opened up by seven levels, all from the surface except the two lower ones. The main haulage level is the 385-foot (above sea-level) and up to this year practically all the ore mined was above this level. Now, however, since the upper ore-bodies are being depleted, hoisting has had to be resorted to through the 4-compartment shaft. For this purpose a new 500-horse-power double-drum Vulcan electric hoist has been installed on the 530-foot level to handle two 10-ton-capacity skips in balance. The old 250-horse-power double-drum electric hoist will be used for handling men and supplies. All the ore is hauled out of the 385-foot level in 10-ton side-dump cars by electric locomotives, and, according to the class of ore, goes to one of three 30- by 42-inch Farrell-Blake crushers, which are on the surface, with large underground storage-pockets beneath them down to the 150-foot level. From this level the ore is loaded directly to 25-ton hopper-bottom railway-cars and hauled by 42-ton electric locomotives to the smelter-bins, which have a capacity of 4,000 tons.

The ore which is high in sulphur is smelted directly in blast furnaces by a process of partial pyritic smelting without previous roasting. The furnace matte, which will run approximately 15 per cent. copper, goes directly to two 20-foot converters, when it is raised to about 35 per cent. copper and then transferred to the 12-foot machines, where it is blown to blister-copper of from 99 to 99.10 per cent. copper. The blister is then shipped to the Nichols Chemical Company, New York, where it is refined.

The compressor plant contains four machines—one 3,500-foot Nordberg direct-connected to a Pelton wheel; one 5,000-foot and one 2,500-foot rope-driven machines; and a new 3,500-foot Chicago Pneumatic Tool Company machine direct-connected to a synchronous motor, making a total available capacity of 14,500 feet of air a minute. A new 12-inch air line was laid down this summer from the compressor plant to the mine, replacing the old 8- and 6-inch line. A new 5,000-horse-power vertical turbine has also been installed this year. The completion of the dam this year ensures adequate power at all seasons. This dam is of the Eastwood multiple-arch

* Summary Report, Part A, 1922, Geol. Survey, Canada.

type, with a crest-length of 680 feet and a central height of 136 feet. It is for storage purposes only and has a capacity of 28,000 acre-feet (1,220,000,000 cubic feet), giving a 100-day power guarantee under normal usage. It is fitted with siphon spillway and three 30-inch valves to regulate the flow into Hidden creek, and thence to pressure-lines as required.

The railway was relaid with new rails during this summer and many other repairs and additions made to the present equipment and the replacement of old equipment. The operating cost was consequently higher this year than normal.

In May ground was broken for a concentrator designed for an initial capacity of, say, 1,500 tons a day. As the smelter uses a charge composed of about six parts of heavy sulphide ore to two parts of the pyrrhotite greenstone ore and one of siliceous ore, it became evident that concentration would have to be used to utilize the greenstone ores. To this end a pilot mill of 100-ton capacity was built some years ago and exhaustive experiments carried on.

From these a method of differential flotation was evolved, which would discard not only the greenstone-gangue rock, but the pyrrhotite as well, and give a ratio of concentration of about 8 into 1. By further experimenting it was found that the pyrite could also be removed, resulting in a 16- to 18-per-cent. copper product, with a good recovery.

The flow-sheet on page 53 shows the simplicity of the process, the flotation-cells of course being the essential machine.

The mill consists of three buildings—crusher plant, concentrator building, and dewatering building—all of steel and reinforced-concrete construction throughout, of a most substantial character.

Briefly, the ore from the mine crusher, about 6-inch size, is hauled in hopper-bottomed railway-cars of 25-ton capacity to the 2,000-ton-capacity concrete bin at the head of the crusher building. From this it is automatically fed to two 36-inch pan-conveyors and dumped on Burch-type ring grizzlies, eliminating everything under 2½-inch size. The oversize goes to two 14-inch Traylor gyratory crushers, which reduce it to 2 inches. This product, together with the undersize from the grizzlies, is then delivered by a 30-inch conveyor to a shuttle-conveyor, which feeds either of two sets of 54- by 20-inch rolls in closed circuit with a Hummer screen, the undersize from which is taken by belt-conveyor to the 2,000-ton-capacity steel catenary ore-bin at the head of the concentrator building.

From this bin the ore is automatically sampled and fed to four conveyors which deliver it to four rod-mills of the Cole type, each in closed circuit, with a drag classifier from which the overflow is 70 per cent. 200-mesh. The overflow goes to a 6-cell rougher flotation-machine, from which the tailings go to waste and the concentrates to a 2-cell cleaner-machine, making a final concentrate and a tailing which is returned to the rod-mill.

The concentrates are then delivered to the dewatering division, consisting of two 10- by 40-foot Dorr dewatering-tanks, from which the thickened pulp goes to three Oliver filters, which deliver the final concentrate cake, assaying from 16 to 18 per cent. copper, to the conveyor, to the cars, to the smelter.

Every machine in the mill is individually motor-driven and electrically controlled from different parts of the mill, making it thoroughly up to date in every detail. Mr. Munroe, the general manager, figures that a crew of twenty-two men for twenty-four hours will operate the whole plant. He also states that the concentrate product will do away with one of the battery of four furnaces now in use in the smelter, and increase the present daily output of about 50 tons of blister-copper by 6 or 7 tons.

The present organization at Anyox consists of H. S. Munroe, general manager; L. R. Clapp, assistant general manager; John Dillon, smelter superintendent; John Swanson, mine superintendent; and C. M. Bagwill, chief accountant.

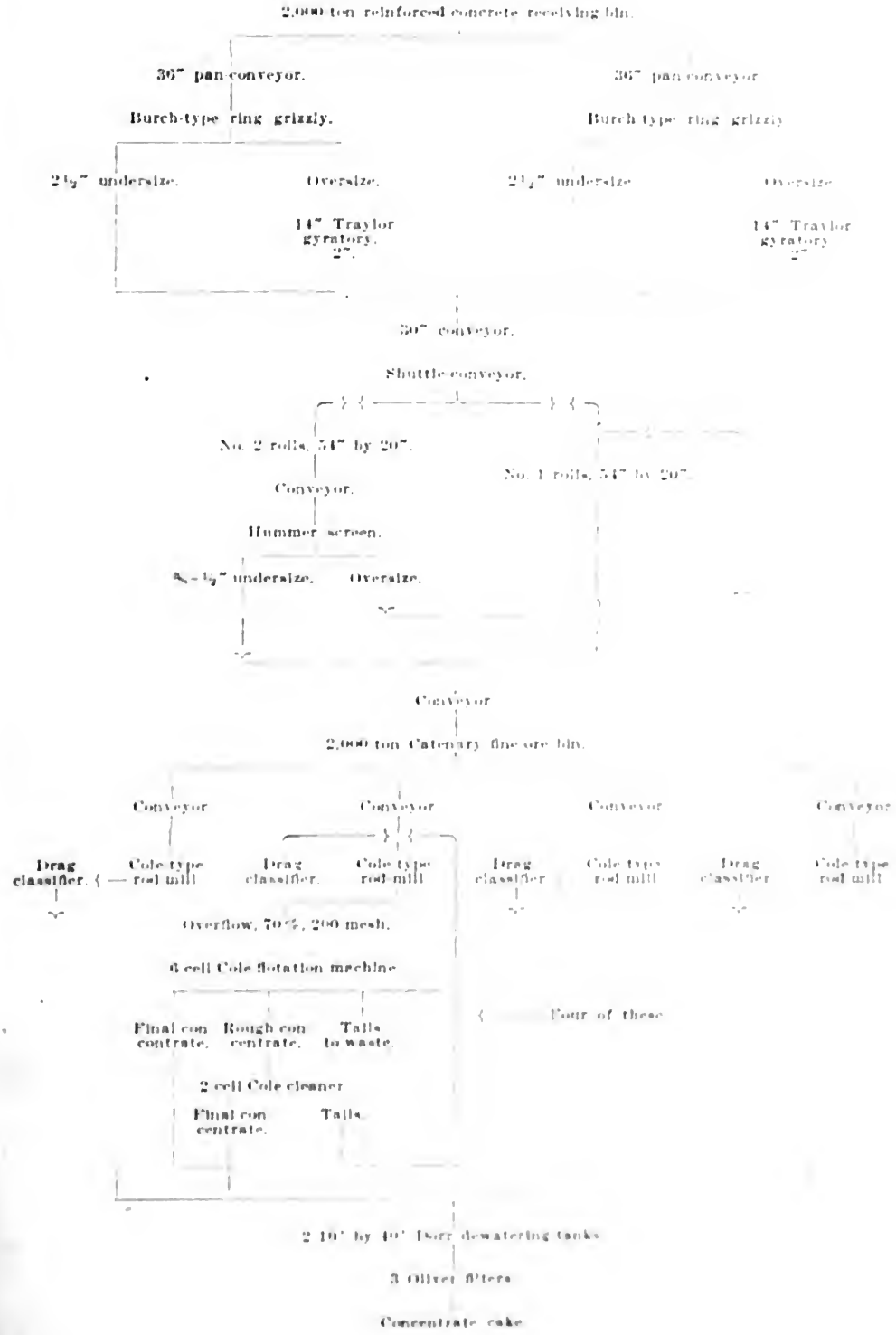
Golskeish Mines, Ltd.

This property, situated on Deep bay, 3 miles below Anyox, has been idle all year. The ore is a very siliceous quartz carrying low values in gold and silver, and was shipped at a fixed minimum price to the Granby Company for flux. Presumably the values are not sufficient to make it a profitable ore, which necessitated closing down when the company developed its own bodies of fluxing-quartz close at hand.

HASTINGS ARM SECTION.

This section lies north from the head of Hastings arm, which is reached by launch from Anyox, a distance of about 18 miles. This year the trail from the head of the arm up O'Neill

Flow-sheet—Granby Concentrator.



river, formerly called the East fork of Sutton river, though it empties into the "salt chuck," has been improved, under a grant from the Mines Department, for about 12 miles, but is far from being a decent trail yet.

The first 5 miles up the trail is in the granite formation of the Coast Range batholith; beyond that is the Eastern Contact Belt, the same as up the Kitsault river, and consisting mainly of volcanic rocks termed the Dolly Varden formation.* Several groups have been located in this area, but it has been prospected very little because of the difficulties in getting into the mineral-belt.

Carpenter's claims and the *Vimy Ridge* group were described in last year's report.

Alice Arm (Proper) Section.

This includes the country tributary to Alice arm and refers to the inlet, not the town. The most important areas in this section are on Lime and Roundy creeks, which empty in on the north-east side of the arm; and the range at the head of these creeks.

There is a fair foot-trail up Lime creek and the trail up Roundy creek has been improved to a sort of pack-horse trail. There was very little done in this section this year.

Keystone Mining Co., Ltd. This company was incorporated in January, 1923, with a capitalization of 200,000 shares of $1 each. The registered office is 921 Birks Building, Vancouver. The holdings of the company comprise the *Sunset* group of seven claims, acquired from G. W. Morley, and seven claims acquired from O. M. Gray, all situated on Roundy creek. The *Sunset* group has been reported on each year in the Mines Report, and as nothing further was done on it this year it is unnecessary to repeat.

E. M. Thornley examined the property for the company the latter part of September and would recommend that certain work be done toward its development. The season was too far advanced to accomplish anything this fall. I therefore recommended that a small appropriation be granted by the Mines Department to assist in putting the trail in condition this fall in order that there would be no delay in the spring. This was done and the necessary improvements made under the direction of O. M. Gray. It is expected that the company will do considerable work next year. In my opinion the showings and conditions on the *Sunset* group are promising.

Theda Bara and Phebe Daniels.—These two claims adjoin the *Sunset* group of the Keystone Mining Company and were staked and owned by Fran Jones, of Silver City, Alice Arm. He claims to have a good showing of silver-lead ore and furnished me with a few pieces for a sample, which assayed: Gold, trace; silver, 1.6 oz. to the ton; lead, 12 per cent.

The *Verona*, *Lynx*, and several other groups have yearly assessments done on them, but no extensive development has been done on any of them.

Beverley Group. This group is situated north of Silver City, on the north-east side of the head of Alice arm. There are five claims in the group—*Beverley*, *Beverley No. 1*, *Beverley No. 2*, *Beverley No. 3*, and *Beverley No. 4*—staked and owned by Louis Reynolds, of Alice Arm. The showing on the claims consists of a number of bull-quartz veins in a split-up dioritic dyke, striking S. 65° E. into the hill and dipping at any angle from 30° to 50° S. This has been exposed by an open-cut about 50 feet long and from 12 to 15 feet deep on the dip of the quartz, continued as a tunnel following one of the quartz veins from 12 to 18 inches wide for about 12 feet and then turning and crosscutting to the foot-wall. A shallow winze had also been sunk on the vein in the tunnel, but had later been filled with muck. No mineralization of any kind could be seen in the quartz, though the owner claims to have found free gold.

Above the open-cut on a gently sloping side-hill, a few places from which the overburden has been stripped indicate quartz across a width of 60 feet. One of these exposures has a rusty-appearing quartz and would stand a little work done on it to get below the surface. The showings are only about 1,800 feet from tide-water and at 750 feet elevation. These quartz-bodies would be valuable for fluxing purposes if they carried even mining and transportation values.

Kitsault River Section.†

This section includes the Kitsault River valley and tributary streams from tide-water at Alice arm to the head of the river, about 26 miles.

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* Geological Survey, Canada, Summary Report, 1921, Part A, Upper Kitsault, by Geo. Hanson.

† Upper Kitsault Valley, B.C., by Geo. Hanson, Geol. Survey, Canada, Summary Report, 1921, Part A.

The report and map of Geo. Hanson* give very helpful geological information of the upper portion of the valley and may be briefly summarized as follows: The rocks are classified into two formations—the Dolly Varden formation, consisting of massive and fragmental volcanic rocks, and the Kitsault River formation, overlying the former, composed of argillites, conglomerates, etc. The copper-belt is included with the Dolly Varden formation, which is locally known as green (or grey) and purple andesites, the former containing in themselves, or along their contact with the purple andesites, all the silver-bearing veins. The high-grade silver values occur chiefly in quartz veins.

In the copper-belt the veins have mostly been formed along shear zones. They are quartz and carry low silver values, but in places good values in copper. The quartz veins in the sedimentary rocks, or Kitsault River formation, contain low values in gold and silver, although the *Esperanza*, in the same formation, has very high-grade silver ore.

The conclusions are: "The volcanic fragmental rocks of the Dolly Varden formation are worth prospecting for silver-bearing veins. The purple and red members of the formation do not appear to contain any silver veins, the grey and green members containing all the known silver veins in the district.

"Secondary enrichment has not proceeded at a uniform rate throughout any area, nor even in any particular vein. Consequently, if a vein is stripped in a few isolated places and found to be too low grade for mining in those places, it does not follow that the intervening parts of the vein are also low grade, and vice versa. In prospecting the silver-bearing veins in the district thorough surface examination is of the greatest value. Surface prospecting would probably be of value along the *Dolly Varden* mineral-zone, the *North Star*, *Toric*, *Ruby* mineral-zone, and extension of the *Ruby* zone.

"If the values are contained in a native-silver or ruby-silver ore, it is probable the silver content will decrease in depth. Where the silver is contained in grey-copper or galena ore the values will probably be more persistent in depth.

"Where surface ore contains thick plates and leaves of silver and similar seams of ruby silver, and where fracturing has been extensive, high values can be expected to continue to greater depth than where surface ores contain very thin flakes of native silver, etc. It is worthy of note that the high-grade silver values are obtained from a siliceous ore. In barite veins the higher-grade vein-matter is found in quartz-ore-shoots."

The mining situation in this very important mining section continues to be most unsatisfactory and discouraging. If it were not for the small shipments made during the year from the *Esperanza* and some little development being done on the *Homestake*, there would have been no outside capital invested in the section whatever. However, the prospectors and mining property owners are wholly optimistic regarding their showings, and are steadily, if slowly, developing them. Whether the stagnation is due to the prices and terms asked for prospects, or because of the short career of the leading property, the *Dolly Varden*, I do not know. But this I do know: that there are showings and values in this section that, if found in other parts of the country, under similar conditions, would be considered well worth developing.

The Dolly Varden Railway was put in repair in the spring for light traffic, such as hand-cars and speeders, and has been thoroughly appreciated by prospectors and others taking in supplies. The upper Kitsault trail was rebuilt and extended to its property by the Homestake Mining and Development Company, Limited, with assistance from the Mines Department.

Esperanza Group.

This group of three claims—*Black Bear*, *Aldebaran*, and *I Claim It* (formerly *Black Bear* group, situated on the west side of the Kitsault river about ½ mile from the town of Alice Arm, is now owned by Mr. Fraser and associates, of Anyox. Mr. Fraser is in charge at the property. The vein is quartz up to 3 feet in width, in argillite country rock, and mineralized with pyrite, some galena and zinc-blende, argentite, ruby and native silver. Small shipments of high-grade silver ore have been made for several years. It is one of the oldest stakings in the district. About $75,000 worth of ore has been shipped from time to time as the high-grade shoots were encountered.

At the time I was at the mine, in October, a fine-looking body of ore had just been struck, consisting of about 3 feet of quartz, of which about 18 inches on the foot wall was beautiful, high-grade ore. Pieces of clean argentite and ruby silver weighing several pounds were being

sorted out in the stope. The property this year shipped to the Granby smelter at Anyox 141 tons, containing 20 oz. gold, 11,107 oz. silver, and 514 lb. copper.

Information at the end of the year is that work will be continued all winter and that shipments are being made from the ore-body mentioned above. A good survey and map of the underground workings, showing the dykes, faults, etc., would be of great help in locating ore-bodies.

Lone Maid Group.

This group lies north of and adjoining the *Esperanza* group and no doubt contains the extension of the *Esperanza* vein. Some surface work done last spring exposed the vein and some very rich ore was found. The main work done was a crosscut tunnel at 1,050 feet elevation, started on a small vein of brecciated quartz, argillite, and country-rock, which was followed for 75 feet. At 54 feet from the collar a crosscut from this vein was driven 84 feet on a bearing of N. 80° W. I took the strike of the main *Esperanza-Lone Maid-Alice* vein in several places and found it N. 50° W. (mag.). The crosscut to the right in the tunnel therefore just about parallels the vein, instead of crosscutting to it as intended.

The drift straight ahead on the small cross-vein followed by the tunnel should cut the main vein in a comparatively short distance.

Alice Group.

This group consists of four claims—*Alice*, *Butte*, *Silver Ridge*, and *Progress*—owned by J. Smith and associates, of Anyox. The claims lie north of and adjoining the *Lone Maid*. The vein can be traced directly from the *Esperanza* through the *Lone Maid* and well over the *Alice* group. There is a fair foot-trail from the end of the wagon-road at the *Esperanza* tunnel. The *Alice* cabin is at 1,500 feet elevation and about an hour and a half from the town of Alice Arm. This foot-trail could be converted into a horse-trail at small cost.

The vein is exposed just above the cabin by stripping and open-cut and lies in a medium-coarse grained grey igneous rock. It strikes N. 80° W. and dips about 65° S. The vein is quartz sparsely mineralized with pyrite and about a foot in width. Two or three hundred yards beyond this showing up the hill, at 1,650 feet elevation, an old tunnel has been driven on the vein, which is shown to be here about a foot in width of sparingly mineralized brecciated quartz and grey igneous country-rock. Same strike and dip as in cut below. At 1,450 feet elevation, or 50 feet below the cabin, a short open crosscut shows bunches and small stringers of quartz in broken-up rock in line with and no doubt the main vein. Just below this a short open drift was run in on the vein, disclosing a width of 14 inches of quartz and andesite fairly well pyritized. The cropping at this point showed some very nice ruby-silver ore on the surface, but none could be found in the 6-foot face of the cut. The vein here is well defined and stands about perpendicularly.

Just below this cut, at 1,400 feet elevation, an open crosscut 12 feet long, continued as a tunnel another 30 feet, encountered the vein, which was drifted on to the west or into the hill for 20 feet. Just west of the open-cut a section of the vein about 6 feet long has been faulted by a cross-dyke, but the vein was picked up on the west side of the dyke. Here it has its regular strike of N. 80° W. and dip 65° S. On the hanging-wall are a few inches of ribbon-quartz and country-rock paralleling the wall, which apparently carries all the mineralization there is, consisting of pyrite and a little galena and zinc-blende. Both the drift cut on the vein and this short drift on the vein directly underneath the cut are decidedly disappointing, as there was a good showing of high-grade ore on the surface. Doubtless the vein on this group contains lenses of high-grade ore similar to those found on the *Esperanza*.

Bunker Hill Group.

This group consists of seven claims—*Bunker Hill No. 1*, *Bunker Hill No. 2*, *Bunker Hill No. 3*, *Bunker Hill No. 4*, *Cougar*, *Bunker Hill Fraction*, and *Rocket*—located by James Calvin, of Alice Arm, with whom is now associated Jos. Tretheway. The claims are situated on the east slope of Haystack mountain on a small branch of Granite creek, the showings being at an elevation of about 2,000 feet. They are now reached by a trail branching from the *LaRose* trail, but a better-grade route would be the continuation of the *LaRose* trail from the shaft, around the side-hill to connect with the *Bunker Hill* trail.

The country-rock is argillites, which tails out into igneous formation farther up the mountain. The showing is a quartz-filled shear-zone in both the argillite and igneous rocks, though in the

Kitsault River, Nass River M.D.

Illiance-Tchitin Divide, Nass River M.D.

latter the shear is merely a tight fracture in the rock, and consequently not much chance for mineralization.

In the softer argillites, however, the vein widens in places to 2 feet of pyritized quartz carrying bunches of galena and zinc-blende. A sample across 2 feet where the vein was practically solid sulphides gave: Gold, 0.32 oz.; silver, 7 oz. to the ton; lead, 2 per cent.

The vein strikes north and south, cutting a number of dykes at right angles as it approaches the igneous formation above. These dykes all show a normal faulting or shearing movement of about 10 feet, the upper or western portion having slipped to the south. There is no replacement or mineralization in the dykes along the shear, from which I judge that conditions farther up the hill in the igneous formation would be unfavourable for ore-shoots.

There is another showing of quartz that has had only a shot or two put in it, to the east of the main vein lying along one of the east-west dykes.

The main vein might be picked up down the hill toward Granite creek and considerable depth obtained. Considering the situation and size of the vein, the ore would have to be pretty high grade to be profitable.

Alice Arm-LaRose Mining Co., Ltd.

The holdings of this company include the *Britannia*, *Britannia No. 1*, *Britannia No. 3*, and *St. Eloi*, situated up Paul Kladne creek on the west side of Kitsault river, about 2 miles from the Dolly Varden Railway, to which there is a good horse-trail, and 8 miles from tide-water at Alice Arm. This is the old *Lattow* group, from which several small shipments of high grade silver ore, ranging from 150 to 353 oz. to the ton, were shipped by the original owners to the Consolidated Mining and Smelting Company's smelter at Trail. In 1920 the present company was incorporated, having its registered office in Prince Rupert, with a capitalization of 1,000,000 shares of $1 par value. Some little work was done the first year of incorporation, but since that time, unfortunately, the property has been idle.

There are two veins on the claims contained in an argillite country rock, termed by Hanson the Kitsault River formation—a small well-defined quartz vein carrying high silver values in galena, grey copper, argentite, and native silver, and a large quartz vein carrying low values on the surface. The last work done was a 42-foot crosscut from the surface, which just reached the big vein when work was closed down. Considerable work has been done on the small vein from which the shipments referred to above were mined. A tunnel was driven on the vein from the surface for 125 feet. This started on ore which continued for about 40 feet in the tunnel. A shallow winze was sunk on this in the tunnel. A winze was then started at the portal of the tunnel and sunk 14 feet on from a few inches to 18 inches of high grade ore, and some stoping done from the bottom of the shaft both ways on the vein. This work shows what looks like a split in the vein, but which is probably a cross-vein mineralized for a short distance back from the main vein. There is very little ore in sight in the shaft now, but I think the possibility of getting ore at further depth in the shaft is excellent.

There is a good horse-trail from the shaft to the railway and a good cabin at the mine making conditions fine for leasing.

Vanguard Group.

This group is composed of four claims—*Vanguard*, *Motherlode*, *Vera* and *Vimrod*—owned by Morris Peterson and the Stromdeck Bros., of Alice Arm. The claims are situated on the west side of the Kitsault, about 4 miles north of the *Dolly Varden*. There is a good trail to the claims branching from the main Kitsault trail at the *Second Thought* cabin, where there is a bridge across the river. The showings lie in the copper-belt at an elevation of about 2,800 feet, or about 1,600 feet above the river.

At 3,000 feet elevation there is an exceptionally fine showing of solid chalcopyrite on the surface about 8 feet in width. A great deal of work has been done below this in tunnelling to try to locate this ore-body at depth. I understand that a good ore-body has been struck in the tunnel this summer, which will greatly enhance the value of the property.

Lucky Strike Group.—Owned by Hauber, O'Hara, McLean, McLeod and McGinnis, of Alice Arm. There are eight claims in the group, situated along the ridge running north from the West fork of the Kitsault to Homestake mountain and in the copper-belt. The showings were described in last year's report, to which the reader is referred.

The *Fox* and *Matilda* and *Blue Ribbon* groups, all lying on Homestake mountain above the *Homestake* group, have had only yearly assessments done. (See former reports.)

Homestake Group.

The Consolidated Homestake Mining and Development Company, Limited, owning the *Homestake* group, consisting of *Homestake*, *Homestake No. 1*, *Homestake No. 2*, *Homestake No. 3*, *Homestake Fraction*, *Homestake Fraction No. 1*, and *Tip Top*, for which applications for Crown grants have been made, has been the only company operating in the Kitsault section this year. On account of repairs necessary on the Dolly Varden Railway in the spring, the amount of trail-building which had to be done from the end of rail at the *Dolly Varden*, the bridge across the Kitsault just above the *Dolly Varden*, the construction of camp and other buildings at the mine, it was late in the season before any actual mining was started. To facilitate transportation on the railway a Ford speeder was purchased, which hauled all supplies from the dock to the end of rail, and from there they were taken to the mine by pack-horse.

The old trail was repaired and about 7,000 feet of new trail and road built. This fall a Sullivan portable compressor of 155 cubic feet capacity was taken part way into the property, and I understand that it will be taken over the snow the balance of the distance. During the winter there are four men at the mine developing by hand-work. Two new log buildings were put up, a cook-house and a bunk-house, each 14 by 24 feet; a blacksmith-shop and compressor building at No. 3 tunnel.

Considerable development had been done previously on the claims, consisting of surface work and three tunnels. No. 1 (or upper) tunnel, at 3,350 feet elevation, is now in 165 feet, the last 10 feet being in the main vein, which is here low grade. This tunnel gives a depth of approximately 200 feet on the vein. No. 2 tunnel was started this year and will give an additional depth of 100 feet on the vein. It is now in 22 feet of the 230 feet estimated as necessary to encounter the vein. No. 3 tunnel was started last year and driven 47 feet. It will take 460 feet to strike the main vein.

This winter's work will be the driving of this tunnel, as it is planned as the main working-level of the mine. A. C. Gerhardi, the manager for the company, has been overseeing the work the greater part of the summer and has made good progress.

Summit Group.

There are two claims in this group, owned by A. Davidson, O. Evindsen, and Don Cameron, situated on the ridge between Clearwater and Trout creeks, at 3,200 feet elevation on the east side of the Kitsault river. The property can be reached by either the Clearwater Creek or Trout Creek trails. Some work was done in 1921 on these claims, consisting of an open-cut along a shear-zone in green andesite-porphyry country-rock, exposing a number of quartz stringers across a width of from 10 to 12 feet sparingly mineralized with galena. Later a crosscut tunnel 150 feet long was driven underneath the surface showings and open-cut, but nothing was found other than a few stringers of barren quartz crossing the tunnel. Since then a couple more cuts were put in about 100 yards to the south of the tunnel. These show similar conditions to those found above—namely, parallel stringers of quartz, small seams of galena, and bunches of galena in the country-rock between the quartz stringers. The zone strikes N. 10° E.

Little or no values are obtained even in the best ore, and altogether the property does not look encouraging.

Yukon and Nome.

These claims are situated south of the *Summit* group and are owned by J. G. Johnson and Seattle associates. The country-rock is green andesite. The showing is a brecciated vein of quartz and country-rock occupying a shear-zone of from 4 to 6 feet wide in the andesite, though the foot-wall is not well defined, seemingly losing its silica and gradually changing into country-rock. The hanging-wall is better defined and has a narrow seam of quartz along it in which is found a little galena here and there, which, however, carries no values of importance.

Mr. Johnson has done a great deal of work on the vein, which can be traced for several hundred feet on the surface. He has made several open-cuts into the vein, sunk a shaft 6 feet in depth, and crosscut the vein above the shaft with an open-cut and tunnel. All this work showed no values to amount to anything, which is quite characteristic of any breccia-filled veins that I have seen in my district. Though the surface indications warranted all the work that was done, I would not advise any further work on this type of vein.

No Name Nos. 1 and 2.

These claims are owned by J. Sexton and Jens Larsen and adjoin the *Summit* group on its west side. Some work has been done by the owners in stripping and open-cutting the vein. The showings thus exposed are similar to those

on the *Summit* group; that is, small stringers of quartz, with small splashes of fine-grained galena right in the andesite country-rock, which, because of the meagre silicification, do not impress me as indicative of anything more important.

Queen and Queen Fraction.

These claims were staked and are owned by Harry Williams and Charlie Gustafson and adjoin the *Hiland No. 1* and *Hiland No. 2*, belonging to Paddy Morley and Tom McCrostie, which in turn adjoin the *Chance* group. There are four open-cuts on the *Queen* along the bluff on the north bank of Trout creek. These cuts all show the typical stringers of quartz in the prevailing green andesite country-rock, but in one cut there is also a width of about 2 feet of siliceous rock fairly well mineralized with fine-grained galena. A sample of this gave: Gold, trace; silver, 6.5 oz. to the ton; lead, 12 per cent.

Chance Group.

This group was formerly the *Last Chance* group described in previous reports. The group now consists of the six claims—*Chance No. 1*, *Chance No. 2*, *Chance No. 3*, *Chance No. 5*, *Caribou No. 1*, and *Caribou No. 2*—owned by Paddy Morley and Archie McPhail, of Alice Arm. The claims lie east of and adjoining the *Moose* group and are about three-quarters of a mile up the Trout Creek trail from the Kitsault river.

The rock formation in which the vein lies is a porphyry pyritized with disseminated small grains of pyrite and very similar in appearance to the pyritized quartz porphyries of the Salmon River section. East of the porphyry-belt the country-rock is the prevailing andesite of this area, the contact dipping south-east.

The vein lies in the porphyry, but close to the contact. In places the andesite overlies the porphyry far enough to cover the vein, which breaks up through the andesite, where it is not so strong or as well mineralized as in the porphyry.

The main surface showing is a section of the vein exposed along the side-hill for a length of about 300 feet by the erosion of the foot-wall. This shows a vein matrix of quartz, barite, and calcite (in which are embedded round boulders and pebbles of andesite), mineralized chiefly with pyrite, galena, a little chalcopyrite and zinc-blende and some argentite. Fair silver values are obtained from average samples over this surface, while there are streaks and patches of high-grade galena and argentite.

In 1919 three or four diamond-drill holes were drilled in this showing, the horizontal holes proving a considerable width (exact footage not known) of a good milling-grade ore, but a couple of inclined holes to prove the ore at depth failed to locate the vein at all. Since then the owners have done considerable work themselves in open-cutting and stripping, which has traced the vein for 600 to 700 feet on the surface, showing its strike to be N. 35° to 40° E. and the dip about 70° W. The last cut at 2,650 feet, 100 feet lower elevation than the large exposure, shows a well-defined vein 12 feet wide, a sample across which assayed: Gold, 0.04 oz.; silver, 18.6 oz. to the ton; and a trace of copper. The vein-filling is a breccia of quartz, jasper, barite, and calcite, mineralized chiefly with pyrite, but in places carrying considerable galena, some sphalerite, and occasionally grey copper.

A crosscut tunnel was started by the owners two years ago at an elevation of 2,500 feet, which would cut the vein in about 280 feet. This work has been driven 60 feet and is being advanced a little each year.

On the upper claims of the group I noted a well-defined vein between 5 and 6 feet wide, of mixed quartz and porphyry, striking east-west and dipping south at a high angle.

Although this vein carries small values, about 5 oz. silver to the ton, which is unimportant in itself, it would be interesting to do some development-work at the intersection of this and the main vein, where conditions would be favourable for a large ore-body and enrichments.

The property now needs deeper development, and I would consider it a good gamble for any one to furnish the money for this for an interest in the property.

Moose Group.

(*See* 1921 Report.) This group consists of five mineral claims—*Moose No. 1*, *Moose No. 2*, *Moose No. 3*, *Moose No. 6*, and *Moose Fraction*—staked by Don Cameron and owned by him and associates, of Alice Arm. The claims are situated on the north side of Trout creek, about 3½ miles from the terminus of the Dolly Varden Railway. The property has been explored by surface work and three tunnels and has a good camp and equipment. No work has been done during the past two years.

The upper (or No. 1) tunnel, at an elevation of 2,300 feet, is in about 100 feet in milling-grade ore all the way. Crosscuts at a point about 60 feet from the collar show a vein-width

of about 12 feet, 6 feet of which assays 30 oz. silver to the ton. Samples taken along cross-fracturing assay up to 600 oz. a ton.

The middle (or No. 2) tunnel has been driven only a short distance. The lower (or No. 3) tunnel is the main working. This is at 2,000 feet elevation and is in a little over 200 feet. The first 15 feet in the tunnel is on ore which was cut off at this point by a cross-fault, the next 115 feet finding no ore. The tunnel was then turned to the right and the vein picked up and drifted on for 75 feet along the foot-wall. Crosscuts show the vein to be from 10 to 22 feet wide, of low-grade ore, showing better values on the hanging-wall side and high grade on cross-fractures. At the face one of these cross-fractures was followed over to the hanging-wall and good values obtained.

It looks as if the general grade of the ore would carry sufficient for milling, with the probability of high-grade "sweetening" ore being found on or near the cross-fracturing and faults.

Climax Group. This group of two claims—*Climax* and *Climax No. 2*—is owned by Olier Besner, of Prince Rupert. The claims are situated adjoining the *Moose* and *Silver Horde* groups on the north side of Trout creek, which empties into the Kitsault river about 2½ miles up from the *Dolly Varden*. A great deal of surface work was done in trenching through the overburden to trace the vein, which is without doubt the extension of the *Moose* vein. Also the vein has been crosscut on the surface in several places. It lies in the andesite-silver belt and is up to 20 feet in width of quartz, more or less mineralized with pyrite and galena. The values where the vein has been exposed on the surface are low, but it is well worth further development.

Tiger, Musketeer, and Silver Horde Groups.—Nothing has been done on any of these groups this year, and as they have been described in former reports the reader is referred to these reports.

Toric Group. This group is owned by Strombeck Bros., of Alice Arm, and consists of four claims—*Toric, Anglo, Moose*, and *Lamb*. They are situated across the Kitsault river from the *Dolly Varden* and *North Star* groups. There are two camps—one at 1,000 feet elevation and the other at 2,000 feet elevation—from which a great deal of exploratory work has been done on each of the two veins, upper and lower, by the two owners.

On the upper vein numerous open-cuts trace the vein on the surface for about 900 feet, proving its strike to be N. 80° E. (mag.) and dip 70° N. Three tunnels have been driven. The lower (or No. 1) tunnel, at 1,875 feet elevation, was run on a bearing of N. 10° E. (mag.) and is therefore a crosscut to pick up the vein outcropping 30 feet above it. It was driven 75 feet without encountering the vein, and crosscuts to the east 25 feet and west 12 feet likewise failed to locate the vein. The cropping above the tunnel and an open-cut a short distance to the east show a well-defined vein about 7 feet in width. Some distance east of the No. 1 tunnel, another tunnel (No. 2) at 2,100 feet elevation was driven a distance of 45 feet, cutting the vein, which here shows a width of 10 feet of quartz well mineralized with pyrites. About 75 feet east of No. 2, on the same level, another short tunnel was driven about 15 feet on what appears to be a vein. This work, however, indicates it to be a faulted section from the vein above. Several open-cuts trace the vein for several hundred feet beyond No. 2 tunnel, the alignment of these cuts showing that portions of the vein are faulted to the west similarly to the block showing in No. 3 tunnel. Though the vein is uniformly strong, well defined, and well mineralized, the values are low throughout, running up to 10 to 12 oz. silver to the ton. I would advise, however, that some exploratory work be done along the fault-lines, for the high-grade ore-shoots on the *Dolly Varden* were found under very similar conditions.

On the lower vein the first work done is about 150 feet above the railway-grade and exposes a width of 20 feet, as follows: 5 feet of banded jasper, barite, and quartz on the foot-wall; then 8 feet of country-rock; then about 4 feet of ore similar to the foot-wall vein. The country-rock is grey andesite. A grab sample of broken ore from here assayed 17 oz. silver. A number of open-cuts have traced this vein up the hill for 500 feet or more, showing its strike to be N. 80° E. (mag.) and dip 65° N., the same as the upper vein. Two or three of these openings show about a foot of ore in a 4-foot vein, carrying high values in native silver, ruby silver, and argentite. These cuts were being extended to prove the continuity of the high-grade ore.

Considering its accessibility and the encouraging showings with the amount of work done, this property has a good chance of becoming an important producer.

Central Group. This group consists of three claims—*Central*, *Homeguard*, and *Traveller*—owned by Wm. McFarlane and Dan Kennedy, of Alice Arm. The property lies on the east side of the Kitsault river, 11 miles from Alice Arm. The showings are of exceptional interest, in that they are immense, detached sections of a vein lying in the slide-rock. One of these sections shows a face of ore 12 feet 6 inches wide, from which sectional samples gave assays as follows, across 4 feet 6 inches: Gold, $2.40; silver, 6 oz. to the ton; copper, 3.9 per cent.; 8 feet gave: Gold, 60 cents; silver, 2.4 oz. to the ton; copper, 3.5 per cent.; an average of about $13 a ton, with silver at 60 cents an ounce and copper at 12 cents a pound.

The ore is a breccia of green andesite country-rock and calcite, carrying disseminated chalcopyrite, pyrite, and a little galena, and would, I judge, concentrate from 6 to 8 into 1.

A great deal of work has been done by the owners in trying to locate the vein from which these huge boulders came, but so far without success. The width of and values in the ore certainly indicate a vein well worth finding.

Silver Bar Group. The Silver Bar Mining and Development Company, Limited, was incorporated in 1922, with a capitalization of 1,000 shares at $1 each, its head office being in Vancouver. The holdings of the company consist of the *Silver Bar* group of eight claims, situated on the North-east fork of Kitsault river and owned by A. McGuire, of Alice Arm. Nothing has been reported of any operations since the company acquired the property.

Horseshoe Group. This group is comprised of the six claims—*Horseshoe*, *Primary Metals*, *Virgin Shamrock*, *Calumet*, and *Calumet No. 1*—situated on McGrath mountain and owned by Elmer Ness, of Alice Arm, and partners. I am informed that there is a promising showing up to 18 inches wide of chalcocite carrying very low values in silver. The results of work this season on the showings is reported as very satisfactory.

Silver Band Group. There are four claims in the group—*Silver Band*, *Sunrise*, *Lucky Strike*, and *Tip Top*—owned by G. W. Morley, Al. Clary, and others. The group is situated on the north-east end of McGrath mountain. The country rock is siliceous slate, badly distorted near the vein, which consists of bands of quartz and slate, the quartz mineralized more or less with zinc-blende and small amounts of galena. The whole formation is so badly distorted that it is difficult to trace the mineralized belt through. The owners have done considerable work in open-cutting, stripping, etc., but any values obtained were low grade. One of the owners, Mr. Morley, claims, however, to have uncovered a more promising showing this summer on the North-east fork slope.

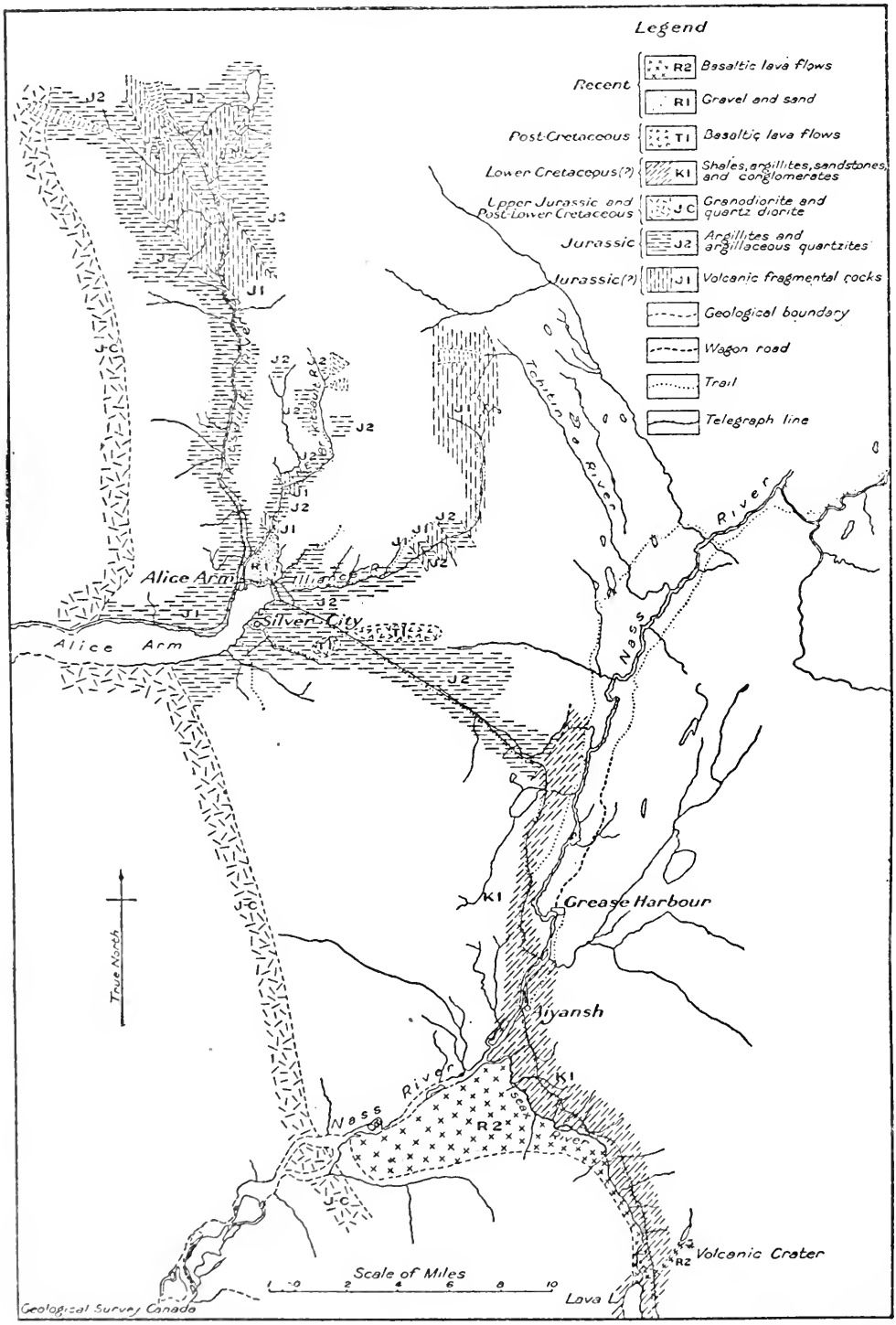
Other groups on McGrath mountain have had the yearly assessment work done to keep them in good standing. These groups include *Silver Bell*, *Lone Star*, and *Standard*, for descriptions of which the reader is referred to previous reports.

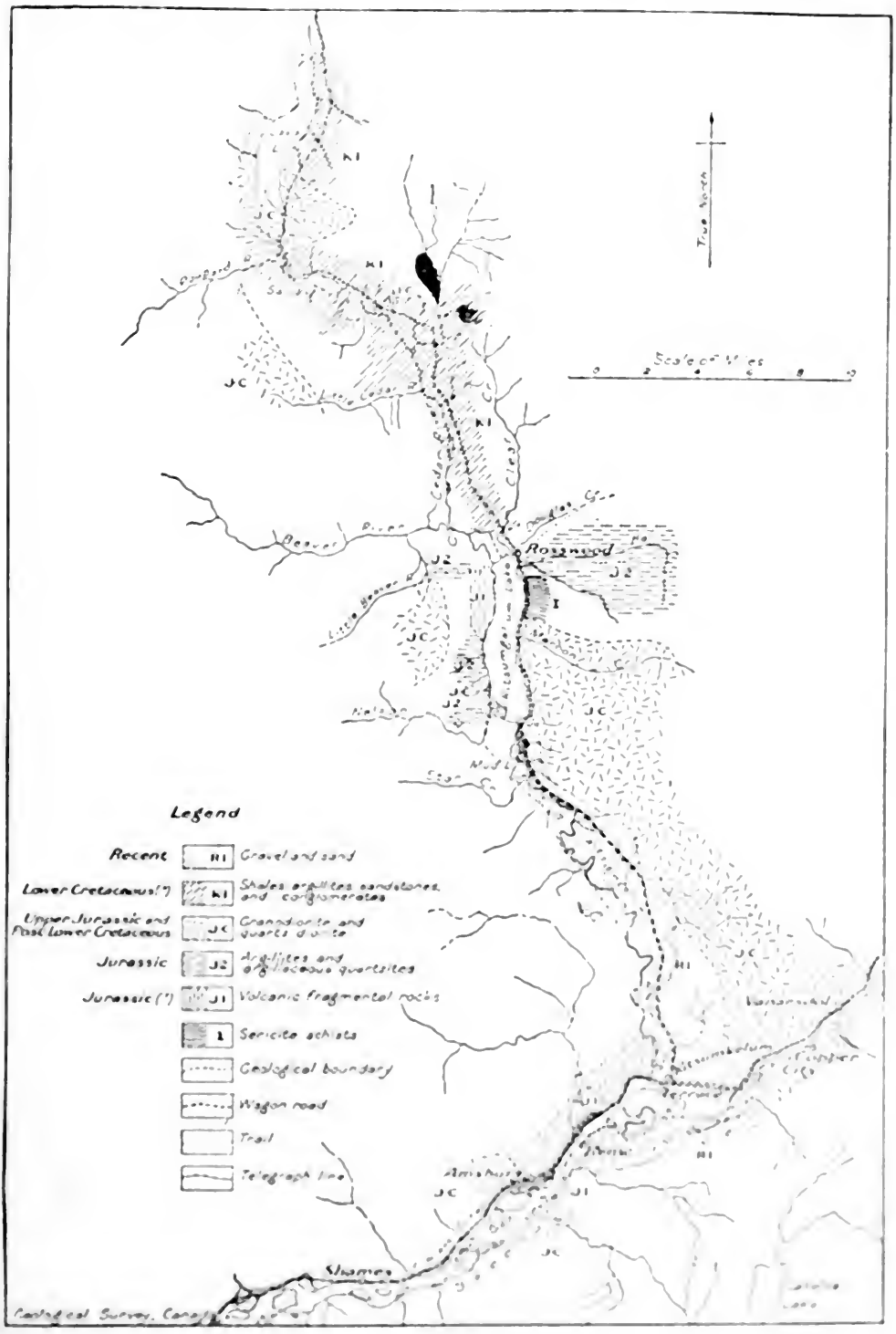
Illiance River Section.

In his reconnaissance of this section, George Hanson[1] says: "On upper Illiance river the tufaceous sediments and tuffs have a north to north-north-west strike. On the east and also on the west side of the river the rocks dip gently to the west, but in a zone which is followed by the stream they dip steeply to the west. There appears to be a sharp flexure in the formation, the west side having moved downward in relation to the east side. Along the flexure the rocks are sheared and along this sheared zone ore solutions have ascended and formed a number of mineral-deposits. The *Bellevue*, *United Metals*, *Silver Bell*, and half a dozen other mineral properties have been staked along this zone. The mineral-zone is strongly defined and may contain rich and perhaps extensive shoots of ore. The mineralization is of the silver-lead type."

There are several groups in this section, notably the *Copper Creek*, *Bellevue*, *Silver Bell*, Ingraham's claims, *United Metals*, *Monarch*, *Old Woman*, and *Silver Star*, which have had serious development-work done on them and have been described in former reports. As no work of any note has been done on these properties since, I will refer readers to Reports of 1919, 1920, and 1921.

[1] G.S.C. Summary Report, 1922, Part A.


Legend
Recent
R2 Basaltic lava flows
R1 Gravel and sand
Post-Cretaceous
T1 Basaltic lava flows
Lower Cretaceous(?)
K1 Shales, argillites, sandstones and conglomerates
Upper Jurassic and Post-Lower Cretaceous
J C Granodiorite and quartz diorite
Jurassic
J2 Argillites and argillaceous quartzites
Jurassic(?)
J1 Volcanic fragmental rocks
Geological boundary
Wagon road
Trail
Telegraph line
Alice Arm
Silver City
Alice Arm
Tahtsa River
Nass River
Grease Harbour
Iyansh
Nass River
Skeena River
Volcanic Crater
Lava
True North
Scale of Miles
0 2 4 6 8 10
Geological Survey Canada


True North
Scale of Miles
0 2 4 6 8 10
Rosswood
Beaver River
Little Beaver R.
Cedar R.
Clear Cr.
Nelson
Star Cr.
Mud L.
Amsbury
Shames
Copper City
Legend
Recent
R1 Gravel and sand
Lower Cretaceous(?)
K1 Shales argillites sandstones and conglomerates
Upper Jurassic and Post Lower Cretaceous
JC Granodiorite and quartz diorite
Jurassic
J2 Argillites and argillaceous quartzites
Jurassic (?)
J1 Volcanic fragmental rocks
I Sericite schists
Geological boundary
Wagon road
Trail
Telegraph line
Geological Survey, Canada

PORTLAND CANAL MINING DIVISION.

The following references may prove useful to those wishing further information on the geologic features and ore-deposits of the Division:—

Minister of Mines' Reports, 1918 to date.

Portions of Portland Canal and Skeena Mining Divisions, Skeena District, B.C., by R. G. McConnell, Geol. Survey, Canada, Memoir 32, 1913.

Geology and Ore Deposits of Salmon River District, B.C., by S. J. Schofield and Geo. Hanson, Geol. Survey, Canada, Memoir 132, 1922.

The Geology of the Portland Canal District, by Victor H. Wilhelm, Mining and Scientific Press, Vol. 119, pp. 95-96, 1921.

Notes on the Salmon-Unuk River Region, by J. B. Mertie, Jr., U.S. Geol. Survey, Bull. 714, pp. 129–142, 1921.

Ore Deposits of the Salmon River District, Portland Canal Region, Alaska, by Lewis G. Westgate, U.S. Geol. Survey, Bull. 722-C, 1921.

Coast and Islands of British Columbia between Douglas Channel and the Alaska Boundary, by V. Dolmage, Geol. Survey, Canada, Summary Report, 1922, Part A.

This Division includes the country north of Pearce island, in Portland inlet, on the east side of Portland canal (the west side is Alaska), to the summit of the range, and north to Mount Brown, north of which it includes the upper drainage-basin of the Nass river.

The northern portion, although over the Bear and Salmon River divides and on the Nass slope, is a portion of this Division, because all that area is at present reached by way of Stewart, where the Government Recording Office is situated, and is therefore very convenient for obtaining information of records and recording.

The town of Stewart, at the head of Portland canal, is the distributing centre of the Division. It is the most northerly seaport in the Province, and is therefore the natural outlet for the immense Interior country. Stewart has a weekly service by the Canadian National steamships and Union steamships from Vancouver and Prince Rupert; has also Government telegraph service and radio service at Hyder, Alaska, 2 miles from Stewart.

The reader is referred to a section in this report under "Prospecting" for information regarding trails, etc., out of Stewart and likely sections for prospecting in this Division.

Government statistics for the year for the Portland Canal Mining Division show that there were issued 372 miners' licences, an increase of 37 over last year; 626 claims were recorded, an increase of 166 over 1922; and 914 claims represented by assessment-work, against 619 last year, or an increase of 295, which is a good criterion to the great mining activity in this section.

This has probably been the most progressive year for this Division, for all sections of it have been under serious development. A number of new companies have been incorporated, and I estimate that altogether over $500,000 have been expended in development-work in this Division this year. There are several outstanding features in the year's mining, notably the "bringing-in" of a new producer in the *Outsider* at Maple bay by the Granby Company, though owing to the incompletion of the tramway no shipments can be made until January. However, everything is in readiness so far as the mine and other equipment is concerned.

The Premier Gold Mining Company has had another very successful year, paying $1,700,000 in dividends, or 34 per cent. on capitalization. This brings the total dividend disbursements up to $4,850,000 in a little over two years, or a total return of 97 per cent. of capitalization, the greatest record of any mine in Canada.

The opening-up of further shoots of high-grade ore on the No. 3 level, together with the development of good ore several hundred feet below present workings, ensures the continued success of this wonderful property for some time to come.

The continued successful development of the Indian Mines Corporation property and the announcement of the construction of a concentrator, power plant, etc., are of first importance.

The very encouraging opening-up of the *Dunwell* on Glacier creek is not only very gratifying to that company, but it will have a far-reaching beneficial effect on the Bear River section of this Mining Division.

A number of other properties have been undergoing comprehensive development-work, the more prominent being the *Maple Bay*, adjoining the *Outsider* at Maple bay; Georgia River claims; *Gloria* at head of Bulldog creek; *Idaho*, *Patricia*, and other groups on Marmot river;

Premier Extension, Big Missouri, Hercules, 59, Yellowstone, Eldorado, Bromide, Unicorn, B.C. Silver Company's properties, and others on Salmon river; *Silverado, Monaco, L. & L. George, Independence, M.C., Prince John*, and others on the Bear river and its tributary streams.

A great deal of prospecting and small development was done throughout the Division by prospectors, both on ground already staked and in new sections.

There is every reason to think that the co-operation of the Provincial Government with the Alaska Forestry Department will result in at least a pack-trail up the Unuk river from tidewater, which will facilitate the exploration of that portion of the Division.

Needed assistance was granted by the Department of Mines, under the provisions of the "Mines Development Act," for the following roads and trails in this Mining Division:—

Big Missouri trail to upper valley of Salmon river.
Glacier Creek trail to *Mobile* and other properties.
Salmon Glacier trail to properties on west side of Salmon glacier.
Repairs to wagon-road to Premier Company's property.
Marmot River trails.
North fork of Glacier creek to *Dunnell*.
B.C. Silver Mines, Limited, wagon-road improvements.
Indian road and high-level bridge, serving all properties on west side of Cascade creek over to Salmon glacier.
Salmon River road extension, serving all properties on east side of Cascade creek to north of the Premier Company's ground.
Bear–Nass trail, repairs, to enable prospectors and others to get over on the Nass slope as far as Meziadin lake.

The fact that mineral-property owners can obtain assistance for trails on recommendation of the Resident Engineer is stimulating development-work on their holdings. In a few exceptional cases recommendation was made that trails built on their claims be allowed the owners as a portion of their assessment-work.

The Provincial Government this year completed a wagon-road from Stewart to the dock, at a cost of approximately $50,000, connecting with the Salmon River wagon-road and ensuring permanent transportation facilities from Stewart to the mines in the Salmon River valley. This, in conjunction with the new bridge across the Bear river, built this year at a cost of $20,000, provides the Bear River valley also with excellent shipping accommodations. The present wharf facilities at Stewart have again become too limited to meet the requirements of this developing district.

PORTLAND CANAL (PROPER) SECTION.

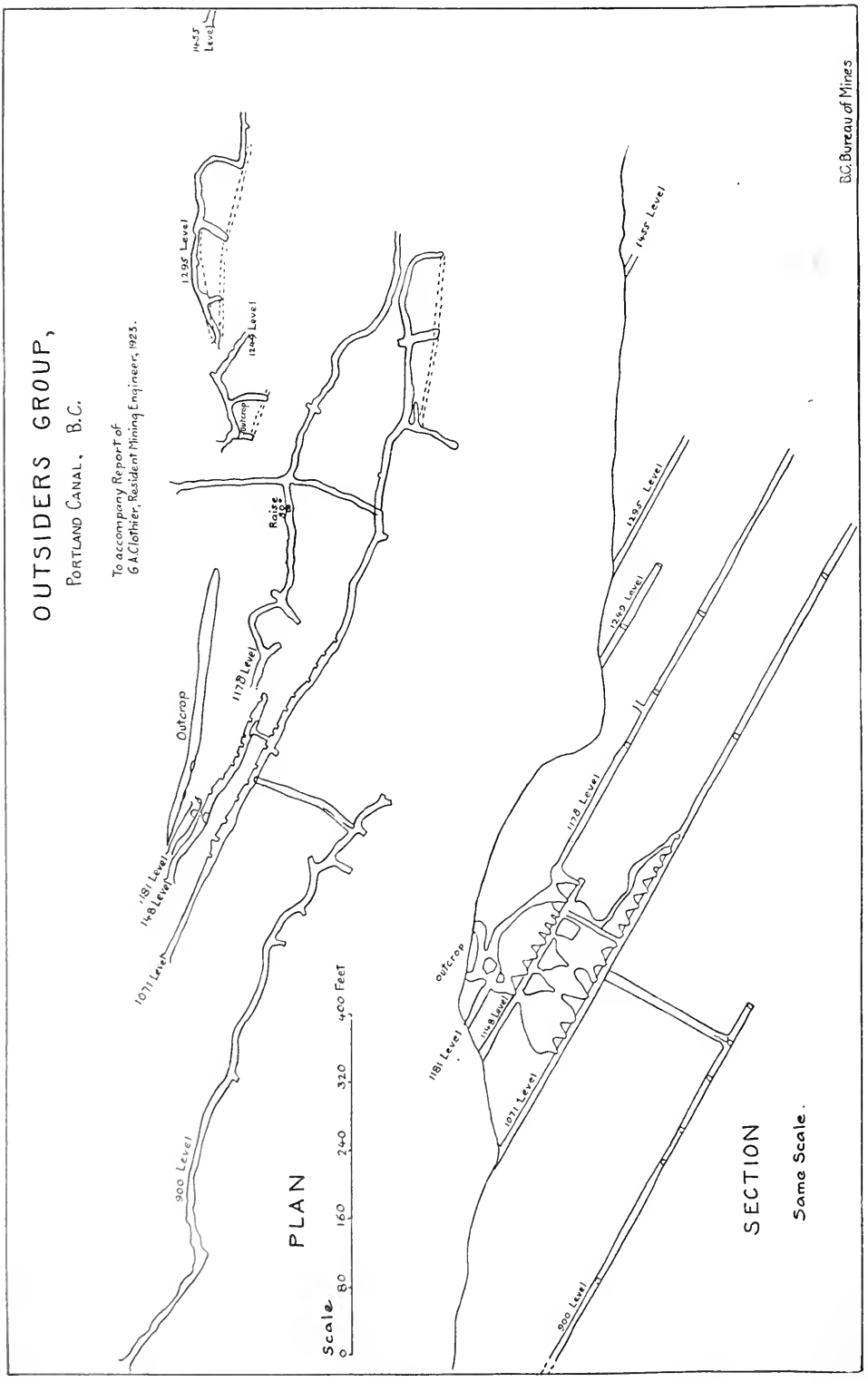
This section consists of the country bordering Portland canal on the east, from its mouth just north of Pearce Island to its head at Stewart, and is a portion of the Portland Canal Mining Division, with which it should not be confused.

Outsider Group. This group consists of eight mineral claims—*Flow, Tunnel Fraction, Copper* (see 1921 Report), *King, Regina, Hope, Brown, Summit*, and *Constance Fraction*—situated at Maple bay, about 35 miles down the canal from Stewart. This is one of the oldest properties in this Mining Division and was operated in 1905-6 by the Brown-Alaska Company, which shipped several thousand tons of 2.8-per-cent. copper ore to its own smelter at Hadley, on the Kasaan peninsula, Prince of Wales Island, Alaska. It was afterwards acquired by Martin Woldson, of Spokane, Wash., and associates, who in 1918-19 drove a lower tunnel at 925 feet elevation, or 175 feet vertically lower than the old 1,100-foot level from which the ore was shipped.

The 925-foot level was driven about 700 feet following the foot wall, from which six crosscuts were driven to the hanging-wall, showing the vein to be from 8 to 16 feet wide of quartz fairly well mineralized with pyrrhotite and chalcopyrite, the whole averaging less than 2 per cent. copper content.

Practically all the ore had been stoped above the main level, now the 1,070-foot level, a little remaining on either end of the stope. The drift beyond the stope for several hundred feet showed only patches of ore.

The upper tunnel at 1,200 feet had been opened up by a crosscut from the surface of 150 feet, and drifting 150 feet south and 400 feet north on the vein exposed an ore-shoot 350 feet in length.


OUTSIDERS GROUP,
PORTLAND CANAL, B.C.
To accompany Report of G.A. Clothier, Resident Mining Engineer, 1923.
PLAN
Scale
0 80 160 240 320 400 Feet
900 Level
1071 Level
1148 Level
1181 Level
Outcrop
1178 Level
Raise 48
1295 Level
1345 Level
1240 Level
SECTION
Same Scale.
B.C. Bureau of Mines

This was the condition of the property when acquired on a royalty basis by the Granby Consolidated Mining, Smelting, and Power Company, Limited, and work started in the latter part of September, 1922, since which time it has been developed and equipped to a shipping property.

Contracts were let late in 1922 for drifting on the vein above the 1,200-foot level. Three tunnels were driven, totalling about 700 feet, the upper tunnel being at about 1,500 feet elevation. The ore will average here about 4 feet in width on each wall of the vein, with about 8 feet between, and is of better grade than the lower workings. This summer a lot of surface work was done above these workings, which show a vein-width up to 15 feet, which means a big tonnage of ore above the 1,500-foot tunnel.

Three crosscuts were also driven from the old drivage on the 1,070-foot level beyond the stope, and the vein, from 4 to 5 feet wide, was picked up in each one, ensuring additional tonnage on that level.

The 900-foot level is the head of the tramway and will be the main working level. Chutes have been put in and all preparations made for stoping as soon as the tramway is completed. A raise was put through from the 900- to the 1,070-foot following the ore, which will permit of all ores from the upper levels being dumped to the 900-foot (or tram) level.

The ore occurrences are very similar to those of the company's *Bidden Creek* mine, lying on a contact of greenstone with altered and silicified argillites, but are more continuous.

The tramway from the 900-foot level to the beach bunkers is about a mile. It is of the Riblet type, built under contract by that company, and will be completed early in January, 1924, when shipments of 100 tons a day of from 2½- to 3-per-cent. ore will be sent to Anyox. The tramway will have a capacity of 100 tons in eight hours. The beach bunkers at the lower end of the tram have a capacity of 1,000 tons, from which the ore is loaded direct to scows by a 500-foot travelling-belt, now completed.

A compressor of 450 cubic feet capacity has been installed between the mine and the beach, run by water-power furnished by 1,500 feet of 16-inch pipe from the creek above. Here there are also two Diesel engines installed as auxiliary power.

From the compressor house a 20-inch water line extends to the beach for power to a turbine-driven generator, used for lighting and running the loading-belt from the bunkers to the dock. A good wharf and approach has also been constructed.

The old cabins on the beach and the old camp at the mine have been utilized for accommodations for about seventy men steadily employed all year. However, more comfortable quarters will be provided in time, a large bunk-house at the mine being now under construction.

The work at this property has been under the supervision of Ed. Conway, of the company's engineering staff, with Palmer Cook in charge of operations at the mine.

Maple Bay Groups.

(*See* 1921 Report.) These groups, consisting of twenty-two claims and fractions, situated at Maple bay, south of and adjoining the *Outsider* group, are owned by the original stakers, W. Noble, of Stewart, and associates. The property has been under bond for the past year to the Granby Company, which is operating the *Outsider* mine.

During the summer some 1,500 feet of diamond-drilling was done in four holes on the *Eagle* claim, indicating a very satisfactory tonnage of commercial copper ore. Considerable surface work was also done on different showings and the company will resume both diamond-drilling and other work as soon as conditions permit in the spring. Altogether the outlook for this particular area of the Portland Canal section is very favourable for a continuous large production of low-grade copper ore.

Georgia River Mining Co.

(*See* 1922 and previous reports.) This company at one time owned eight claims, known as the *Guggenheim* group, but at present the holdings are two claims. They are situated about 10 miles up from the mouth of Georgia river, which empties into Portland canal about 17 miles from Stewart. About 5 miles of trail were built some years ago, following the river up from its outlet. This year the property and several adjoining claims were acquired by the American Mining and Milling Company and some little exploratory work done by way of open-cutting and stripping.

I did not have time to visit the property this season, but I understand that the preliminary work exposed several small quartz veins, from which good gold values were obtained. Judging from the extent of and values in the ore-exposure in the Bullion tunnel, where the development work to date has been done, I would consider these other veins well worth opening up, and

would expect them to develop a sufficient tonnage of good-grade milling-ore to supply a small concentrating plant, and by efficient supervision make the property yield fair returns on the money invested in it.

North Country Mining Co.

This company was incorporated in November, 1923, with a capitalization of 2,000,000 shares at $1 par value. The registered office is in Vancouver. Evidently the company was formed to take over the holdings of the Gloria Mining Company, which owned the *Gloria* group of twelve claims at the head of Bulldog creek, which empties into the east side of Portland canal, between the Georgia and Marmot rivers, and heads near the head of Georgia river

I understand that some work has been done in open-cutting, exposing what appears to be a large body of low-grade ore. A crosscut tunnel has been started, in which work will be prosecuted through the winter. This tunnel will obtain considerable depth and explore a portion of the ore-body said to assay up to $30 a ton on the surface.

I had not the opportunity of visiting the property this year. The work done has been under the supervision of A. Linke, the original staker and one of the present owners in the new company.

Marmot River Section.

This section is the area drained by the North and South branches of the Marmot river, which empties into the east side of Portland canal about 4 miles below Stewart, from which point it is reached by boat.

There is a good pack-trail from the beach to the forks, about 2½ miles, where there is a good cabin for the use of any one. Here the trail branches, following each fork—up the South fork to the foot of the glacier, a distance of 3 miles, and up the North fork for about 3 miles, the upper end following along the north bank of the glacier. An appropriation was made by the Mines Department for the continuation of this North Fork trail until it met the glacier, in order to furnish transportation for the *Idaho* and other properties across the glacier. The trail was built a short distance up to a rock bluff, which could have been worked around, but for some unaccountable reason the road-boss turned the trail straight up the hill, and I presume went as far as the money lasted. This trail should be continued through as outlined originally and permit of shipments being made from the *Idaho* group.

The Coast Range granite-contact is about at the forks, and the areas at and between the heads of the forks are therefore very likely localities for ore-deposits. The country has been pretty thoroughly staked and is being increasingly prospected each year, with the result that several prospects are showing up very encouragingly. With the probability of several small shippers being developed, it will become necessary to widen the present trail from the beach to the forks to at least a sleigh-road width for winter haulage at first, to be completed into a wagon-road and extended through to the South Fork glacier as developments and shipments warrant. About a mile of trail is required after crossing the tongue of the South Fork glacier up to Magee pass.

I believe that close prospecting in this Marmot River section will discover commercial bodies of lower-grade ore. It is about the most favourable section in the Portland Canal Division, other than right on the canal, for mining operations.

Idaho Group.

(*See* 1922 Report.) This group consists of seven mineral claims and is owned by Clay Porter, of Hyder, Alaska, and associates. The property is situated on the west side of the North Fork glacier, at 4,700 feet elevation and about 1,000 feet above the glacier. There is a good pack-trail from the opposite side of the glacier down to the forks, and thence by the main trail to the beach, a total distance of approximately 6 miles. This trail should be extended a short distance up to the glacier to a much more advantageous point for crossing. The elevation at the forks cabin is 750 feet; at the Green Point cabin, 2,000 feet; at the glacier at the foot of hill below Porter's camp, 3,000 feet; at Porter's camp, 3,900 feet; and at the upper showing, 4,700 feet. The old workings are described in last year's report. This year's work was done on different veins. The prevailing country-rock is andesitic schist.

The first new work above the cabin, at 4,400 feet elevation, is a crosscut tunnel driven 135 feet, cutting a large oxidized vein showing on the surface at a depth of about 50 feet. The cropping of this vein can be followed some distance, apparently striking about N. 45° E. (mag.). It is thoroughly oxidized, except for occasional embedded lumps of galena, assaying up to 500 oz.

silver to the ton, very probably from silver-sulphide contents. It was thought that the depth obtained would likely be below the surface oxidation, but such was not the case. The tunnel was extended to the above distance for the purpose of cutting another vein, but the ground proved to be so shattered that it necessitated timbering, and, there being no handy timber, this work was abandoned.

About 300 feet above this, work was started on another showing, striking N. 40° W. (mag.), about right angles to the lower vein, and dipping about 55° S.W. A tunnel was driven about 25 feet, exposing a vein of from a few inches to 2 feet in width, following along the foot-wall of a quartz-porphyry dyke. On the hanging-wall of the vein there are a few inches of soft oxidized material, assaying up to 50 oz. silver to the ton; then a foot or more, showing some oxidation, but a larger proportion of galena, coarse and fine, with which are associated silver sulphides and native silver, the whole assaying about 510 oz. silver to the ton. This portion of the vein is being broken down separately and sacked, both oxides and sulphides, of which a careful sampling gave over 500 oz. silver and 8 to 10 per cent. lead. At the time of my examination the tunnel had been driven 15 feet, from which about 4 tons of ore had been sacked. The oxides are being replaced by the sulphides as the tunnel advances. About 15 tons of ore is now ready for shipment.

In the foot-wall, extending across about 20 feet, there are several small oxidized veins, and I therefore think it would be a good idea to crosscut into the foot-wall when the tunnel has been driven far enough to get below the oxidation. Altogether the vein is a very promising one and should improve as depth is obtained, as the oxides will probably give place to the more valuable sulphides.

* This appears to be a cross-vein to the other veins, both above and below, on the claims. If it could be drifted on to its intersection with some of the other veins the chances are very favourable for larger bodies of high-grade ore.

I am informed that the owners have organized a syndicate, consisting of 15,000 units, of which 8,400 go to the owners for the property and 6,600 into the treasury, of which 1,000 are to be sold to the public at $10 a unit, the proceeds to be used for further development and shipping.

Aberdeen Group. This group, consisting of four claims—*Copper King*, *Copper Queen*, *Victoria*, and *Triumph*—adjoining the *Idaho* group on the south and west, is owned by H. C. Magee and associates, of Stewart. Not much has been done beyond surface prospecting. The owners erected a stone house this fall, built about a mile of trail from the glacier, and expect to do considerable exploration-work next year.

Engineer Group. The three claims in this group—*Engineer No. 1*, *Engineer No. 2*, and a fraction—are owned by Geo. Bunn, of Stewart. More work was done on the vein this year in open-cutting, showing satisfactory improvement. Another showing higher up is reported by the owner, but in his absence at the time I visited the property I did not see it.

Washington Group. The claims in this group—*Carrie*, *Ruth*, *Vivian*, *Ellen*, *Castle Hill*, *Black Bear*, and *Black Bear No. 1*—are owned by R. E. Lundvall, of Hyder, Alaska. They are situated beyond the South Fork glacier about a mile on the north side of Magee pass and on the granite-contact. A trail is needed from the glacier up to the head of the pass, serving this group, the *Engineer* group, and other claims.

High-grade ore has been found at several places on the surface. The owner has driven a tunnel over 100 feet, the owner claiming that this year's work was very encouraging. I did not get up to the property this year.

Magee pass is evidently formed along the contact of the Coast granite and adjoining altered rocks. There are several worthy showings on the north side of the pass which could be opened up a little if a trail were provided.

Patricia Group. (*See* 1922 and previous reports.) H. C. Magee, one of the owners, had a small crew working on the property all summer. The tunnel was extended 15 feet and prospecting along the big dyke up the hill carried on. There is a strong mineralization along both sides of this dyke, making it well worth extensive systematic prospecting. Small shipments of galena-pyrite ore could be made from the lower tunnel.

Yearly assessments were done on the numerous claims in this section, including the *Montana* group, *Horseshoe* claim, *Fraser* group, *North Fork Basin* group, and Brown's claims.

BEAR RIVER SECTION.

This section is slowly but surely again coming into mining prominence. It includes all the country up the Bear River valley and tributary valleys north of the head of Portland canal and the town of Stewart.

It was the prominent section in 1909–11, but intensive "wild-catting" had the inevitable disappointment, and it has been "marking time" ever since, until last year. This season, however, has seen a considerable revival of interest, and the very successful development of the *Dunwell* mine on Glacier creek will go far toward restoring confidence and interesting operators.

This property furnishes a very interesting and instructive object-lesson to prospectors and claim-owners, who conclude that, because a country has been staked and prospected for a number of years, further effort is useless. The Dunwell Mines, Limited, and Stewart Mining Company have now consolidated their holdings, which were probably some of the first stakings in the Portland Canal country (the latter staked in 1905), and it is only now, nineteen years later, that it shows every probability of becoming a valuable property, though it had previously been considered a thoroughly prospected piece of ground.

As noted under "Prospecting," the section is well provided with roads and trails, and there are few places that are not very accessible for mining operations on any scale.

The Portland Canal Short Line Railway, built by D. D. Mann in 1910–11, extending from tide-water at Stewart to the old *Red Cliff* mine, a distance of 14 miles, is of course badly out of repair, but the grade is in most part in good condition, and with the renewal of the bridges could be put in operating condition at a comparatively small outlay.

Though this is an old section and has been pretty thoroughly staked from time to time, it is still one of the best fields for prospecting in the district. From Stewart to Meziadin lake, 36 miles, is all in the mineralized Eastern Contact Belt. A branch trail up Surprise creek, between Bear River divide and Meziadin lake, opens up another 20 miles along the belt. From Bear River divide east there are probably not more than a dozen claims staked, and from there north to the headwaters of the Unuk river, about 40 miles, is a country worthy of any prospector.

The new road from the dock to Stewart and the new bridge across Bear river places the Bear River valley in excellent condition for shipping facilities as far as Ward's pass, about 6 miles. From this point to American creek, about 8 miles farther, the road is useless for heavy haulage on account of Ward's Pass hill, the trestle and grade at Muddy gulch, and wash-outs above that. It will be necessary to put this road in condition if the upper valley is to be developed.

Silverado Group. This group, consisting of four claims and a fraction, is situated at an elevation of about 4,000 feet opposite the town of Stewart, on the east side of the head of Portland canal, just south of the Stewart glacier. It is owned by John Haahti, J. W. Stewart, *et al.*, of Stewart. Two years ago the property was in a fair way of being developed; camps were put up, trails built, a tramway constructed part way down the hill, and some work done in driving in on a small flat quartz vein heavily mineralized with grey copper and carrying high silver values. However, operations were unsatisfactory and the bond was returned to the owners.

Since then some further work has been done by the owners in extending the tunnel, who report that the showing of high-grade ore in the face is quite satisfactory. Early this season the property was bonded to Seattle interests, but owing to some hitch no further work has been done.

This property has always impressed me as having a good chance of developing into a small profitable producer. The small vein, on which the tunnel is being driven, will, I believe, produce enough ore to pay for the cost of driving through to the main and larger veins, which crop on the surface. These are from 3 to 6 feet in width, carrying scattered grey copper in sufficient quantity, from surface indications, to make fine mill-feed. An alternative method of attacking the property would be to go around the hill farther from the present tunnel and drive a crosscut tunnel to intersect the vertical veins. It would require several hundred feet of crosscutting, but would obtain great depth on the veins. Should they come up to expectations as indicated by the surface showings, the property ought to be a valuable one.

Dunwell Mines, Ltd.

(*See* 1922 Report.) The company was incorporated in April, 1922, and is a specially limited reorganization of the Nass River Lands Limited, which was incorporated in 1913. The capitalization of the Dunwell Mines, Limited, is 350,000 shares of the par value of $1 each, with the registered office at Victoria. The company's holdings consist of some twenty-four claims and fractions, in which are included the claims of the old Stewart Mining and Development Company, all situated on the north side of Glacier creek and extending from the railway-track up the hill. The situation is ideal for mining operations and transportation.

The general rock formation is termed by McConnell the "Bitter Creek formation," defined as argillite, some tufaceous beds, and occasional bands of limestone. The *Dunwell* vein is of brecciated quartz and argillite, filling a well defined shear in the argillite, striking about S. 80° E. (mag.) and dipping flatly to the south at from 30° to 45°. Surface work exposes this for 300 feet or more, showing it to be about 6 feet in width, of which 4 feet on the foot-wall is heavily pyritized quartz with some galena and zinc-blende, the remaining 2 feet on the hanging-wall containing a greater proportion of argillite and also heavily pyritized.

No. 1 tunnel was driven below this cropping, obtaining about 50 feet in depth. At 50 feet from the portal a small north-south fissure cutting the *Dunwell* vein was crossed, and from that point for 15 feet a small body of high grade ore was drifted on. Beyond this stringers of ore in a vein 4 to 6 feet wide makes a low-grade ore.

No. 2 tunnel, gaining a further depth of about 150 feet on the vein, was then driven. At 240 feet from the portal this tunnel encountered a north-south vein which was cut diagonally through to the *Dunwell* vein, which joined in on the foot-wall side. About 60 feet of mineralized ground, including the *Dunwell* vein, was crossed in this work. The cross-section here shows 12 inches of quartz, striking N. 10° E. (mag.), and which I judge to be the hanging-wall of the north-south vein; then about 30 feet of argillite, in which are small stringers of quartz (this portion very low grade); then 4 feet of solid sulphides, chiefly pyrite, carrying some galena and sphalerite; then 15 feet of mixed ore, probably a low-grade milling-ore; then 15 feet of solid sulphides, as before, chiefly pyrite carrying bunches of galena and sphalerite and assaying about $26 a ton, and is the *Dunwell* vein. This was drifted on both ways from the crosscut, to the west 105 feet and to the east 150 feet. The west drift followed the ore through to the hanging-wall of the north-south vein, where it apparently swerves to the right and conforms with that vein so far as present work shows. No break through the north-south vein has yet been found on the hanging-wall side of it. In the east the heavy sulphide ore gradually diminished in about 30 feet, a small vein from 4 to 12 inches wide showing high-grade silver values continued to about 75 feet from the crosscut. The last 75 feet of the west drift is out of ore. Another drift was started on the 4-foot vein of sulphides and driven east 55 feet, paralleling the *Dunwell* vein, and therefore ran out of the sulphide shoot, which is in the north-south vein.

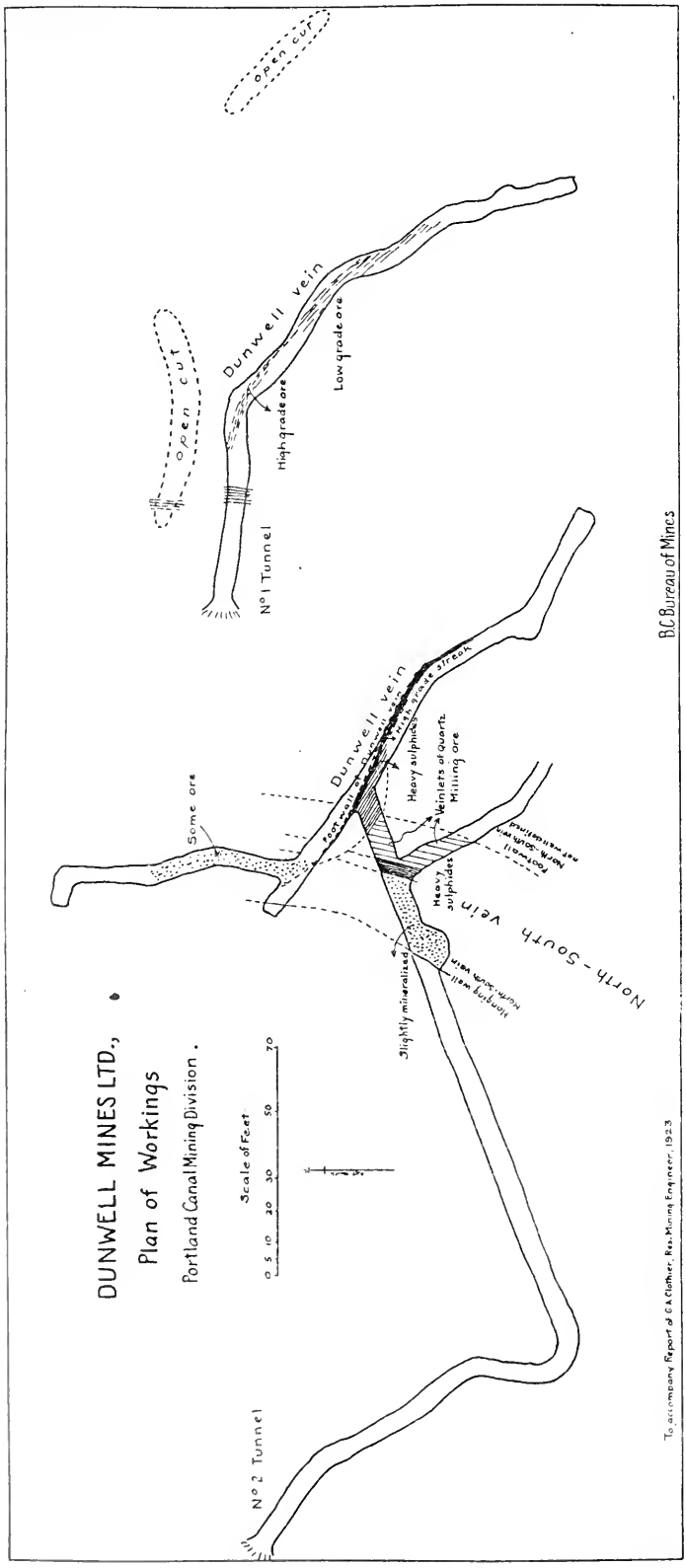
The No. 3 tunnel has been driven 340 feet, giving a vertical depth of 177 feet below No. 2 tunnel. At this distance the north-south vein showing in No. 2 tunnel was encountered early in January, 1924. Subsequent information is to the effect that the diagonal cut being driven across the vein is showing up a wide vein of very satisfactory values. This is a most important development, for should the ore-body prove equal in extent and values as on the No. 2 level it will indicate a large tonnage of good grade milling ore.

The management has planned to start another tunnel 170 feet vertically lower than No. 3, and since this will be a considerable distance west of the portal of No. 3 there are very good chances of encountering other veins of the north-south series, which, when followed to their intersection with the *Dunwell* vein, will doubtless make commercial ore-bodies, as has been demonstrated by development to date.

There are at least four known north-south veins which the *Dunwell* vein may cut, and should ore-bodies similar to the one now being developed form at each intersection (and why not?) the Dunwell Mines will make a very important producer. The property has been efficiently and economically developed so far and I think has a most encouraging outlook.

Mobile Mines, Ltd.

This company was incorporated last year and acquired the *Mobile* group of mineral claims on Glacier creek, above the Portland Canal Mining Company's ground. There are five claims in the group—*Automobile* Nos. 1 and 2, *Allen*, *Leah*, and *Maybe*. The original showing consisted of a quartz vein up to 18 inches wide in a shear-zone in argillite country-rock. In places on the surface the oxidation


DUNWELL MINES LTD.,
Plan of Workings
Portland Canal Mining Division.
Scale of Feet
0 5 10 20 30 50 70
Dunwell vein
Open cut
Open cut
High grade ore
Low grade ore
No 1 Tunnel
Dunwell vein
Foot wall of Dunwell vein
High grade streak
Heavy sulphides
Veinlets of Quartz
Milling ore
Some ore
Heavy sulphides
North-South vein
Foot wall North-South vein not well defined
Hanging wall North-South vein
Slightly mineralized
No 2 Tunnel
B.C. Bureau of Mines
To accompany Report of G. A. Clothier, Res. Mining Engineer, 1923

was 8 feet in width. Several open-cuts had been made along the vein, from which a composite sample of the quartz, varying from 4 to 10 inches wide, assayed 311 oz. silver to the ton. On the strength of this showing the property was acquired and over $20,000 spent in development work.

Work was started in the winter and strenuous work was necessary to open up the trail, build a camp, and get in supplies. This, however, was accomplished and over 600 feet of cross-cutting subsequently done.

The top tunnel was driven 60 feet, following a stringer of ore. Two intermediate tunnels were driven below this, the upper one showing from 4 to 6 inches of ore assaying 200 oz. silver to the ton, the lower one having no ore of any consequence.

A lower tunnel was then driven 450 feet, following a well-defined vein of from 2 to 4 feet wide, striking N. 25° W. and dipping 65° W., and a crosscut driven 55 feet, but no ore was found. This work proved conclusively that there are a few short lenses of ore near the surface, extending down probably 40 feet, but the tonnage of ore proven would be very small and unprofitable.

It was decided that sufficient work had been done to demonstrate that the possibilities of the property were not favourable and work was discontinued. About 15 tons of ore was taken out in development, assaying 200 oz. to the ton, and it is estimated that there are 50 tons more that could be easily mined. It is unfortunate that the ore did not prove more continuous, as the company was financially prepared to go ahead; but quit, with money in the treasury.

L. & L. Group.

This group, consisting of three claims—*L. & L. No. 1*, *L. & L. No. 2*, and *Marion Fraction*—is situated on the east side of the North fork of the Middle fork of Glacier creek. The claims were staked and owned by the late Jack Lockwood and are now under the administration of John Hovland, Hyder, Alaska. The property was bonded in the spring by Frank Breeze and associates, of Vancouver. There is a good pack-horse trail to the property from the Portland Canal Mining Company's concentrator about 5 miles long, and from there to the dock at Stewart by wagon-road is another 5 miles. The country-rock in the vicinity is a stock or mass of augite porphyry, about 1½ by 2 miles in area.

As described in the 1922 Report, considerable work had been done by the owner, consisting of extensive open-cutting along the vein and a drift-tunnel 125 feet in length. The surface cuts and stripping have traced the vein for about 300 feet from the portal of the tunnel up the hill. This exposes a quartz vein varying in width up to 8 feet, containing from 1 to 3 feet of heavy sulphide ore of zinc blende and arsenical iron in about equal proportions, with some galena and grey copper, the latter two evidently carrying the high silver values. A ton of sorted ore shipped several years ago gave returns of: Silver, 273.5 oz. to the ton; lead, 22.1 per cent.; zinc, 11.5 per cent.; silica, 21.5 per cent.; iron, 11.4 per cent.

This year a contract was let for the driving of the tunnel 100 feet by hand, with the expectation of getting in to the downward extension of the surface ore-exposures. At a distance of about 135 feet from the portal a short narrow lens of ore was drifted through that gave very fair silver values (exact assay not known), and a few rounds were taken out in a raise on it. The balance of the tunnel to the face showed more or less ore of fair value, but nothing comparable with the surface ore.

I am therefore of the opinion that the first ore-shoot encountered in the tunnel corresponds to the ore exposed in the first, or lowest, cut on the surface. Such being the case, this angle of the rake of the ore into the hill would throw the second exposure on the surface beyond the present face of the tunnel a short distance. At any rate, the surface ore-exposures are of sufficient size and value to justify the driving of the tunnel another 100 feet or more.

Mimico Group.

There are four claims in this group—*Mimico*, *Mimico No. 2*, *Rocester*, and *Second Relief*—owned by H. McClymont, of Stewart, and A. Aldridge. The claims are situated on the South fork of Glacier creek, about 1½ miles up the *Ben Bolt* trail from the Portland Canal Mining Company's concentrator. There is a nice showing of ore exposed in a surface cut across the trail, consisting of quartz in a country-rock of argillite. In places the vein is solid sulphides a foot wide, of pyrite, galena, and zinc blende, the cleanest galena assaying up to $130 a ton.

Mr. McClymont, who had charge of the work, reports to have done about 175 feet of underground work and that the results have been satisfactory. Work will be resumed next summer.

A good cabin and blacksmith-shop have been built and the property is very favourably located for operating. I did not see the property this season.

North and South.

These claims are owned by James McKay, of Stewart, and are situated north of the Dunwell Mines holdings on the divide between Glacier and Bitter creeks.

The claims are now under bond to G. Sieffert, who has organized the North and South Syndicate in Vancouver on a basis of 300 units of the par value of $200 each. To provide development funds 75 of these units have been sold for $15,000 and work will be commenced as early in the spring as is permissible.

The showing is said to be a pyritized quartz vein, traced on the surface for several hundred feet by open-cutting, from 10 to 20 feet in width and containing values up to $20 a ton in gold and silver.

Sunshine Group.

This group of two claims—*Sunshine* and *Sunshine No. 1*—owned by Fred Young and Godfrey Anderson, of Stewart, is situated on the west bank of the North fork of the Middle fork of Glacier creek, just across the glacier from the *L. & L.* group. It is reached by the *Dunwell–Lakeview* trail and is about 5 miles from the wagon-road at the Portland Canal Mining Company's concentrator. The general rock formation appears to be a greenish igneous rock containing bands of argillite, probably McConnell's Bitter Creek formation.

There are a number of surface showings on the claims, but whether they have any relation to each other or not has not been shown by the amount of work done. On the *Sunshine* claim, about 100 feet beyond the old cabin, there is a good exposure of about 8 feet in width of chalcopyrite ore. The vein, as nearly as can be determined, here strikes N. 20° E. and dips from 50° to 60° to the west. The vein is quartz, mineralized with chalcopyrite and pyrite, and is about 3 feet in width at this particular cut, averaging 10 per cent. copper. Below this cut, toward the glacier, several small cuts have been put in, exposing small veins and bunches of fine chalcopyrite, but the vein showing above appears to have broken up into a number of small stringers.

Last year, while under option to the Granby Consolidated Mining Company, a tunnel was driven about 130 feet on a direct north bearing (mag.). It was started about 100 feet below the showing mentioned and cut a number of small stringers of copper ore. At 28 feet from the portal a crosscut was driven due east for 270 feet. This and the main crosscut shows a fissure striking N. 35° W. and another at right angles to it. No ore of any importance was found in the work, so the Granby Company gave up the option early in the spring.

About 450 feet up the hill from the old cabin, at 3,650 feet elevation, another cropping, of possibly the same vein, has had a few shots put in it, showing from 3 to 4 feet of fairly good chalcopyrite ore in a quartz vein up to 8 feet wide.

About 50 feet below this, there are indications, in the bed of a small creek, of another strong vein, striking N. 30° W., which would intersect the one just previously mentioned. These are very promising showings and deserve a little opening-up.

Also it would be good prospecting to crosscut both ways from the face of the lower tunnel. It looks as if from surface indications a short crosscut 30 to 40 feet to the east from the face should pick up the vein exposed in the crosscut east of the old cabin, where the showing is certainly good enough to justify getting some depth and drifting on it.

There is a good new cabin on the property and the old one could be easily made serviceable.

Other claims on which work has been done this year in this vicinity are: *Evening Sun* and *Columbia*, on the South fork of the Middle fork of Glacier creek, owned by William Rush; *Excelsior* and *Eagle*, on the south side of the South fork of Glacier creek, also owned by William Rush and partner; J. Watkins claims, above the *Mimico* group; *High Grade* and *Mayflower* groups, owned by H. P. Gibson and situated north of and adjoining the *Dunwell; Tyee* group, adjoining the *Mayflower* and *Dunwell*, owned by James McKay; *Dandy* group, north of and adjoining the *Dunwell; Ruth and Francis* group on the North fork of Glacier creek, owned by James Nesbitt and Andy Archie; *Lakeview* group (*see* 1922 Report), owned by James McKay and situated adjoining the *Dunwell* on the south-east.

In the light of recent developments in the *Dunwell*, all this area of Bitter Creek formation of argillite, tufaceous beds, and bands of limestone will justify very careful prospecting. Intersections of cross-fractures and veins should be especially noted and investigated.

Morning Star Group.

This group, consisting of the *Morning Star*, *Tommigan*, *Tommigan No. 1*, and *Tommigan No. 2*, owned by Bill Tooth, of Stewart, and partners, is situated east of and adjoining the *Sunshine* group. The *Morning Star* claim was purchased from the original owner, Dan Woodmore, by W. R. Tooth, and the *Tommigan* claims were staked this year by Kenny McLeod, A. B. Armstrong, and W. R. Tooth respectively.

On the *Morning Star* claim there is a well-defined vein exposed along the west bank of a small stream for a distance of 700 to 800 feet, gaining a depth of 200 to 300 feet on the dip of the vein in that distance. The strike of the vein is N. 40° E., or slightly more easterly than the main vein on the *Sunshine* claims, and dips in the opposite direction at 40° E. The vein has been overlain by a diorite dyke, which has been eroded and left the vein exposed. Some little work has been done along this vein in short open-cuts, which show about 2 feet of quartz and calcite on the hanging-wall, fairly well mineralized with pyrite and chalcopyrite, and about 3 or 4 feet on the foot-wall sparingly mineralized.

Some stripping was being done further down the hill by the owners, where float indicated the vicinity of a vein, but nothing of importance was uncovered.

Galena, Nabob Nos. 3 and 4.

These claims, owned respectively by Eli Watland, N. Nelson, and R. Young, are situated on Glacier creek just below or west of the *Ruth and Evan's* group. An open-cut just above the trail at 2,700 feet elevation shows a small brecciated vein in slate country-rock, striking N. 10° E. and dipping about 75° S.W. The vein is about a foot wide, of quartz and argillite, mineralized slightly with pyrite and chalcopyrite. A crosscut tunnel has been faced up about 70 feet below this, which apparently will have to be driven about 20 feet to intersect the vein.

Only assessments were done on the several properties on Bitter creek and American creek this year.

George Groups.

These groups are situated on the south side of Bear river, about 6 miles up from the end of the wagon-road and the railway at the *Red Cliff* mine. All the work done to date has been described in previous reports. At present the property is under bond to the Granby Consolidated Company, which, it is expected, will do extensive diamond-drilling in the spring as soon as conditions will permit. There appears to be no doubt as to the merit of the showings on the property, but the physical conditions are such that it will take ample capital to put the property on a producing basis. It is to be hoped that its development will warrant the operation of the railway again and its extension to the mine, as it would be a wonderful encouragement to mining throughout the Bear River valley and bring the mineral-belt on the east or Naas slope of the range within easy transportation.

Murdock Group.—These claims lie on the east slope of the range on Beaver creek. Assessment-work only was done this year on the property by J. Donville, one of the owners, who reports a showing of steel galena.

Several other groups have been staked on the Beaver Creek side in the past two years, but none has as yet had any serious development.

Red Top Group.

This group of claims, owned by J. Connors and J. McNeil, is situated on the north side of Bear river, about 6 miles up from the *Red Cliff* and therefore just opposite the *George* groups. There is a fair horse-trail to the camp, branching from the main Bear-Naas trail a short distance from the bridge across Bear river above W. R. George's cabin. Two years ago the property was under bond to Gus Seiffert, of Seattle, Wash., who did a very creditable amount of development-work, but owing to financial difficulties he was unable to continue work and the bond was relinquished. Very little has been done since.

There are two showings on the property, occurring in greenstone formation, termed the Bear River formation. The upper showing, at 3,870 feet elevation, is a quartz-calcite vein from 5 to 8 feet wide, heavily mineralized with galena and pyrite. On the hanging wall there is about 18 inches of banded quartz containing small lunches of galena. The balance of the vein is a coarse conglomeration of quartz, greenstone, galena, and pyrite, the whole averaging about 20 per cent. lead. The silver content is 16.8 oz. to the ton in ore assaying 70.7 per cent. lead. The vein strikes east and west and dips, with the hill, at about 55° S., and has been traced down the hill for several hundred feet. At 3,540 feet elevation a crosscut tunnel was driven

180 feet toward cutting the vein, but had to be discontinued for the winter. It is estimated that it would require a further 30 to 50 feet to reach its objective.

At the camp another tunnel was driven 132 feet towards exploring a showing of chalcopyrite, which is very much broken up and distorted on the surface. This tunnel will have to be extended probably 75 feet before getting under the surface showings. The property undoubtedly merits development.

Comet, Vetron, and Rufus Groups.—These three adjoining groups, situated on the north side of the Bear river, west of the *Red Top* group, have been fully described in previous reports, to which the reader is referred. Nothing of importance has developed on them since the 1922 Report.

Independence Gold Mining Co.

This company was incorporated on January 24th, 1924, with a capitalization of 1,500,000 shares at $1 a share par value. The registered office is at Stewart. The holdings of the company consist of the *Independence* group of six claims situated on Goose creek and owned by the Fitzgerald Bros., of Stewart. The location of the property is very favourable for transportation, inasmuch as it overlooks the Portland Canal Short Line Railway, with which it could be connected by an aerial tramway at comparatively small expense. There is all kinds of timber, and though I have never investigated it, I think an excellent water-power could be developed in Goose creek for the greater part of the year.

There has been an appreciable amount of work done on the claims at different places, and from these ore-exposures I have always been very favourably impressed with the possibilities of the property as a concentrating proposition. The general country is greenstone of the Bear River formation and resembles very much the andesites of the upper Kitsault river.

In 1920 the property was bonded to the Algunican Development Company, which drilled two diamond-drill holes, one apparently cutting a vein exposed on the surface, but it is claimed that on account of the soft, broken-up nature of the ground the core was incomplete and only low values were reported; the other hole evidently did not reach the ore-body at all.

Some work was done at 1,750 feet elevation, consisting of a 25-foot crosscut tunnel, which apparently has just reached the vein, as some low-grade copper ore is showing. At 3,150 feet elevation, just north of the drill-holes, a vein has been exposed across its full width of about 14 feet. The main portion of the vein is about 5 feet wide, lying in the centre, and consists of a heavily pyritized quartz, with some galena and zinc-blende, in which the principal values are silver, with a little gold. On the hanging-wall side of this vein is a small basic dyke about a foot wide, and bordering the quartz and dyke on each side is a siliceous rock of banded quartz and jasper, also heavily mineralized with pyrite and traces of galena and zinc-blende. Average values of $12 are said to have been obtained across the 14 feet. I understand that a tunnel has since been driven on this vein from this cut, with satisfactory results.

Farther up the hill, at 3,500 feet elevation, an open-cut exposes a vein about 8 feet wide, striking N. 65° W. (mag.) and standing perpendicularly. The gangue is a quartz calcite and a jaspery-looking quartz, carrying a considerable mineralization of pyrite, with some galena showing as well. Another cut up the hill a short distance shows about the same vein-filling across a width of about 20 feet.

All these exposures are strong, well-defined veins and might easily develop a tonnage of milling-grade ore. The ground needs careful examination and well-advised work, not a haphazard expenditure of money.

Prince John Mining Co.

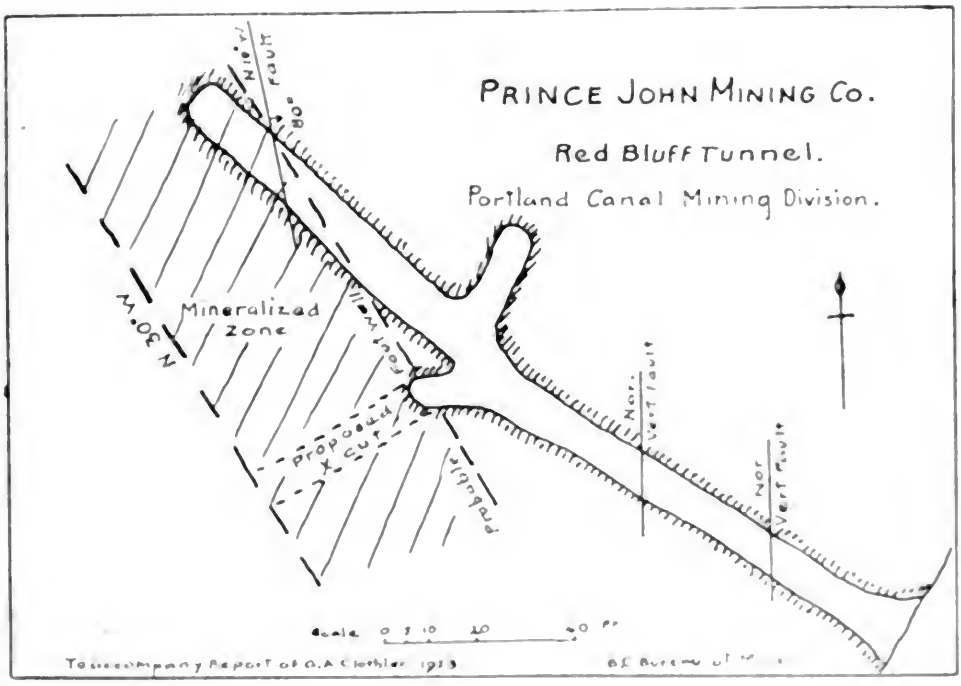
This company was incorporated for $250,000, with its head office in the City of St. Pierre, South Dakota, U.S.A. It was registered in British Columbia in March, 1923, with head office at 304 Central Building, Victoria. The company's holdings are comprised of nineteen claims and fractional claims, as follows: *Prince John Nos. 1* to *10*, inclusive, *Jim Fraction*, *Forrest*, *Forrest No. 2*, *Wedge Fraction*, *Prince John No. 10 Fraction*, *Red Bluff Nos. 1*, *2*, and *3*, and *Texas Fraction*. They are situated on the west side of Bear river, about 4 miles up from Bear River bridge and about opposite Glacier creek.

Last year the Mines Department financed a horse-trail from the Bear River bridge to the foot of the hill at the property, and from there up to the camp and mine the company built its own trail.

Last winter, 1922-23, a crosscut tunnel was driven on the *Prince John* group [illegible] 400 feet under the surface showings and an ore-body exposed in the upper tunnel, where it has a width of 45 feet of low-grade copper ore. The lower tunnel cut only [illegible] in width and did not encounter the main ore-body. Some lateral work from the tunnel will be necessary to pick up this ore-body.

As early as conditions permitted this spring a horse-trail was built from the *Prince John* camp over to the *Red Bluff* showings and a camp built there. The trail was also extended through to the showings on the *M.C.* group at the top of the mountain. While the camp, consisting of log cook-house, bunk house, office, and stable, was being constructed, work was started on a crosscut tunnel just above the camp, to cut a well-defined shear zone in the greenstone schist in which ore was discovered on the surface in different places across a width of probably 50 feet. The tunnel was driven 182 feet, approaching the zone at a small angle, the last 50 feet being in the mineralized belt. (See sketch.)

Two crosscuts were driven from the tunnel, one 20 feet to the west at 92 feet from the portal and the other 21 feet to the east at 107 feet from the portal. The west crosscut showed



some stringers of mineralized quartz at the face and at the time of my examination was being turned to the left with the intention of cutting directly across the schistose zone. I have no information as to the result obtained.

The last 50 feet to the tunnel face showed some stringers of mineralized quartz cutting diagonally across the tunnel, indicating the mineralized zone, but nothing of commercial importance found.

There is a known width of probably 40 feet or more in which small lenses and veins of mineralized quartz have been found carrying good values in gold, indicating that somewhere they may occur with sufficient frequency to make a milling grade ore, or even of such an size to constitute a shipping ore.

Some distance from these mineralized quartz outcrops have been found on which no work has been done, and consequently it is not known whether they are in the same or parallel zones or cross veins.

The impression I got in going over the property was that it is excellent ground for prospecting and that sufficient surface work has not been done to indicate the most advantageous point to attack with underground work.

M.C. Group.

This group, consisting of the *M.C. No. 1*, *M.C. No. 2*, and *Briton*, is situated north of the Prince John Mining Company's ground and is reached by a good horse-trail continued from the *Prince John* trail built by the owners. There are two showings on the property, one right on the summit of the range between Bear and Salmon rivers, at 5,150 feet elevation, and another small showing a short distance to the south of it. The country-rock is the Bear River formation, here consisting of conglomerates and green and red andesites. The vein-filling is a conglomerate containing bunches of solid sulphides, mainly pyrite. A shaft has been sunk about 10 feet deep on it, showing considerable improvement in that depth. The vein is about 3 feet between walls and strikes N. 60° E. and dips 70° E.

No great depth can be obtained on it on the Salmon River side on account of the glacier reaching to within a short distance of the summit. East of the open-cut and shaft and toward the Bear River slope of the hill the vein pinches down to a tight seam and apparently has not been traced any distance in that direction. The slope would seem about the only way to open it up, other than sinking on it on the ridge. About 500 feet south of this showing, at 5,000 feet elevation, is another shear in the andesite country-rock of about 4 feet in width, of heavily limonitized filling. Dipping into this from the south is a small irregular quartz vein paralleling the shear.

The quartz is from a stringer to 8 inches in width and shows patches of chalcocite, assaying high in silver, through it. Specimens of free gold have been found. The only work done on it is a shaft about 8 feet deep sunk on the main shear to the juncture of it and the quartz vein. As the small quartz vein dies out on the surface both ways from the shaft in a few feet distance, it has not the appearance of becoming of any importance.

Late in the fall a diamond-drilling outfit was taken up the hill, and I understand two holes were sunk at the upper showing before the snow came. Neither hole found the downward extension of the ore-shoot showing on the surface, and I am informed that drilling and other work will be proceeded with in the spring.

A very comfortable stone house was built on the property this summer at an elevation of 4,400 feet.

Gold Cliff Group.

This group was staked by Bill Dan and partners, of Stewart, this summer. It comprises the *Gold Cliff Nos. 1* to *5* and the *Gold Cliff No. 1* and *Gold Cliff No. 2 Fractions*, situated on the west side of Bear river between the *Bayview* and *Prince John* group. Some very good-looking samples of chalcopyrite were brought in from the showings, which are claimed to be very promising. The lateness of the season prevented any extensive prospecting of the ground.

Bayview Group.—No work of importance has been done on the property this year and the reader is therefore referred to 1922 Report for information.

Salmon River Section.

This section, with an area of about 60 square miles, lies up the Salmon River valley north of the Alaska-British Columbia boundary-line. It is accessible by automobile road from Stewart to the *Premier*, from which branch roads and trails serve the whole valley.

The following extracts from Memoir 132, "Geology and Ore Deposits of Salmon River District, British Columbia, by S. J. Schofield and Geo. Hanson," published by the Geological Survey, Canada, briefly outlines the most important points: "The ore-deposits fall into three main types: (*a*) A low-grade, complex, siliceous type, with values in the base metals, copper, lead, and zinc (*Province*, *Big Missouri*, *Hercules*, *Forty-nine*, etc.); (*b*) a silver-gold type, rich in silver and gold minerals, including native silver, tetrahedrite, pyrargyrite, freibergite, argentite (*Premier*, *Silver Tip*, certain ore-bodies in *Forty-nine*, *Big Missouri*, and *Mineral Hill*); (*c*) a pyrite siliceous type, with high gold values (an ore-body in the *Premier*).

"Most of the ore-bodies are associated with the quartz-porphyry sills at their intrusive contact with the tuffs of the Bear River formation. On the geological map (No. 1829) the sills are not separated from the tuffs, so that most of the area mapped as being underlain by the Bear River formation may be considered worthy of attention.

"The most favourable geological conditions for the occurrence of ore in Salmon River area appear to be found at the following places: At the contact of the quartz porphyries with the tuffs; in certain beds of tuff and tufaceous conglomerate; in the quartz-porphyry sills. The

slates, although mineralized in some cases, do not appear favourable for the deposition of commercial ore-bodies. The native silver is considered to be of secondary origin.

"The geological conditions which surround the *Premier* extend hundreds of miles north and south along the eastern flank of the Coast Range batholith, and it is most probable that other properties similar to the *Premier* will be discovered in this large unprospected area. Keno Hill in the Yukon, the *Engineer* at Atlin, and the *Dolly Varden* at Alice arm are other properties in this great belt of mineralization. The occurrence of such high-grade ore as occurs in the *Premier* proves conclusively that there are ore-bodies in British Columbia that can be made to pay from the outcrop."

That there has been a great deal of prospecting in this section is evidenced by the fact that about 200 claims were staked and recorded during the year. This means about 10,000 acres, or 16 square miles, of mineralized ground staked in one year and making probably 200 claims in good standing in this section alone. Several groups were located around the head of Salmon glacier and north of that to Tide lake. This whole section is therefore pretty well staked and warrants an unlimited amount of intensive prospecting by the claim-holders.

New trails and roads have been built this year and old ones repaired, making all parts of the section very accessible. The branch road from the *Premier* road to the *Big Missouri* at Joker flats was improved this spring, enabling the *Big Missouri* to put in a compressor plant. This road was extended as a trail across to Long lake. The *Big Missouri* trail was repaired through to the 49 and the Salmon glacier marked out with triangular markers so that pack-trains can follow a safe route from the toe of the glacier to its west fork opposite the 49. A high-level bridge was completed early in the winter across Cascade creek at 13 Mile, which is a great benefit to the *Premier Extension*, *Indian*, and all properties on the Missouri ridge on the west side of Cascade creek. In view of the development of properties in the Missouri Ridge area, in which the *Indian* is at present the most important, and the country across the Salmon glacier, it has been recommended that the present trail be converted into a wagon road from the new bridge, swinging to the west below the *Indian* and attaining the top of the ridge about No Name lake. From this road a short branch can be built to a suitable point on the east shore of the Salmon glacier, from which the glacier may be crossed to the properties on its west side. By this route all traffic will pass the Canadian Customs at the boundary at 13 Mile.

The real development work has been more extensive this year in this section than ever before, as shown by the following: The *Indian* has done about 2,000 feet of underground work and 2,000 feet of diamond-drilling and altogether now has approximately 4,000 feet of underground workings; the British Columbia Silver Mines, Limited, has done about the same amount of drivage and drilling and now has over 3,000 feet of underground work; the Cronholm-Barthelf Mines Company, on the west side of Salmon glacier, drove over 200 feet of tunnel; the Eldorado Gold Mining Company, also on the west side of the glacier, drove over 100 feet of tunnels; the *Big Missouri* had several hundred feet of underground work and a large amount of diamond-drilling; on the *Unicorn* considerable work was done; much open-cutting was done on the *Hercules* and a crosscut tunnel started toward cutting the vein; and in addition to these a great deal of work by smaller operators and individuals.

Over 7,000 feet of drivage and 14,000 feet of diamond-drilling were done by the Premier Gold Mining Company. Its underground workings to date aggregate nearly 5 miles. Altogether the development of the Salmon River section is fulfilling sound and sane expectations and the outlook, therefore, increasingly encouraging.

Premier.

The Premier Gold Mining Company, Limited, was incorporated in 1919 with a capitalization of $5,000,000 at $1 a share par value. It is a reorganization of the old Salmon-Bear River Mining Company, Limited, incorporated by O. B. Bush in the early days of Stewart. In the fall of 1919 the American Smelting and Refining Company acquired the controlling interest from Messrs. Trites, Wood, Wilson and Neill, who had purchased it from the Salmon-Bear River Company and under whose operation it had been brought into prominence. Since then, up to the end of 1923, the property has produced about 280,000 oz. gold and 8,400,000 oz. silver, amounting to over $11,000,000 in values, from which the sum of $4,850,000 has been disbursed in dividends, a return of 97 per cent. on capital stock.

This year (1923) there were mined a total of 145,925 tons, of which 52,162 tons were shipped as Class 1 ore to Tacoma; 34,897 tons shipped as Class 2 ore to Granby Smelter at Anyox; and 57,700 tons milled, producing 7,175 tons of concentrates, shipped to Tacoma and Selby smelters.

and 11 tons of precipitates shipped to Selby smelter. The shipments therefore totalled 95,055 tons, which yielded 117,293 oz. gold and 2,746,551 oz. silver, or a total of $4,206,154, figuring silver at its average price for the year. A total of 62,191 lb. lead was also produced. The dividends for the year were $1,700,000, against $2,750,000 last year.

The above figures are significant in showing the decrease in both gold and silver values in the ore as greater depth is obtained in the mine and the enriched surface ores are depleted. The average gold content a ton has been reduced by 33.3 per cent. and the average silver content a ton by 54.7 per cent. from last year's ore mined, and it is to be expected that as a greater tonnage of the primary ores are mined and less "sweetening" is obtainable from the enriched ores of the upper zone, the average values will be still lower.

The company has the greater part of its holdings along the mineral-zone yet to explore. It may be reasonably supposed that further bodies of shipping-grade ore will be discovered, and also that there will be sufficient enrichments in the primary ore to ensure at least a milling-grade ore to a considerably greater depth than as yet explored by diamond-drilling.

During the year 7,240 feet of development was done and 14,487 feet of diamond-drilling for a guidance to development-work. This work opened up a new intermediate (No. 3) level between No. 4 and No. 2 levels, on which two new stopes have been started and furnished a portion of the ore tonnage at the latter end of the year. A new stope on the No. 2 level also contributed some tonnage, but the bulk of the year's stoping was done in the old stopes. The New No. 3 level has followed the ore, except for a short distance at the shaft, both east and west for a total distance of 900 feet and gives every promise of becoming a very productive level.

From the No. 4 or present main working-level No. 407 drift is being driven southerly to prospect the ground in that vicinity. The tunnel, which is 6 by 7½ feet, had been advanced 1,385 feet at the end of the year. Hand-tramming has been done away with on this level and it is now equipped with electric haulage, consisting of a 3-ton storage-battery locomotive, which is proving very economical.

No. 6 tunnel or level was started from the surface this summer and up to the end of the year had been driven 1,400 feet, but had not yet reached its objective. It is 550 feet vertically lower than the present lowest tunnel, No. 4, and from it the ore-bodies known to exist below the No. 4 level will be explored and developed. It is 8 by 9 feet in the clear and provided with a drainage-ditch for any water that may be encountered.

Milling practice is essentially the same as the original flow-sheet. Some mechanical changes have been made this year whereby the feed to the ball-mills has been reduced in size and larger balls used in the ball-mills. These minor changes have, with better operating conditions and more experienced crews, materially increased the capacity and efficiency of the mill, 57,796 tons being milled this year, against 32,000 tons last year, an average of 169 tons a day the year round, or nearly 200 tons a day for the milling-days. There is no foundation for the local announcement that the concentrating capacity is to be increased to 1,000 tons a day by the erection of a new mill at No. 6 tunnel.

On account of the increase of nearly 50 per cent. in tonnage of ore mined it was necessary to install another compressor to meet the compressed-air requirements. This machine has a capacity of 1,200 cubic feet of air a minute and is driven by a 200-horse-power motor. Its installation overcrowded the old machine-shop and a new building was therefore erected for machine and carpenter shops. The main power was enlarged and a 300-horse-power Fairbanks-Morse semi-Diesel engine directly connected to a 250-k.v.a. generator is being installed.

Several additions and improvements have been made to the surface equipment. Of these, the most important has been the erection of an up-to-date bunk-house, 130 by 25 feet ground-plan, and nine stories high. The building contains 117 large rooms and is equipped with showers, wash-rooms, etc., and is steam-heated and electric-lighted throughout. All the other bunk-houses have been remodelled and put in first-class condition. The kitchens have also been remodelled and enlarged. An apartment-house containing six suites of three rooms and bath each, hot-water heated, has been built for the accommodation of young married couples. A tennis-court constructed of 2 by 4 laid on edge was built on the side-hill between the two camps and has proven very popular.

The managerial staff at the mine is: Dale L. Pitt, manager; Bert F. Smith, assistant manager; Hector McDonald, mine superintendent; and Harry Jackson, chief accountant.

B.C. Silver Mines, Ltd.

This company, organized in October, 1919, with a capitalization of $1,500,000, divided into 1,500,000 shares, owns a group of eleven claims north of and adjoining the holdings of the Premier Gold Mining Company and also a group of eight claims south of and adjoining the *Premier* ground. The "South" group has had comparatively little work done on it. The "North" group has had up to the end of 1923 about 4,000 feet of work done on it in two tunnels. The lower tunnel, just a year ago, had been driven a little over 1,000 feet and had cut one of the main *Premier* veins. This proved to be about 25 feet in width, of an average value of $30 to the ton, and the prospects for the property at that stage of development were exceedingly promising. As a result of this the shares of the Selukwe Gold Mining and Finance Company, Limited, of London, owning about 60 per cent. of the British Columbia Silver stock, went up to 30s. a share, or about twelve times their par value.

This year some 2,800 feet of underground work has been done, but unfortunately no important commercial ore-bodies have been exposed. In the lower tunnel the main *Premier* vein was drifted on for 1,000 feet; ten crosscuts aggregating 436 feet were driven to the east and eight crosscuts aggregating 214 feet driven to the west of this main drift. In addition to this, several diamond-drill holes were drilled from this level through the low grade mineral-zone.

Later in the summer additional equipment consisting of a 325 cubic-feet-a-minute Chicago Pneumatic Machine Company compressor and Fairbanks-Morse engine was installed; a fine mess-house and three bunk-houses providing accommodations for thirty-five men were also built.

An upper tunnel 270 feet vertically higher than the first was then started and at the end of the year had been driven 720 feet, from which two crosscuts had been driven to the south, one 370 feet and the other 145 feet, and one to the north a distance of 140 feet. Work is now being carried on in the upper workings.

The company has approximately 3,000 feet in length of the same mineralized quartz-porphyry zone in which the Premier ore-bodies occur, warranting a most thorough exploration. C. A. Banks is manager and C. B. North in charge of operations at the mine.

Bush Mines, Ltd.

There are six claims in this company's holdings—*Leslie*, *Leslie M.*, *Leslie No. 2*, *Leslie No. 5*, *Leslie No. 6*, and *Mahood*—situated north of and adjoining the British Columbia Silver Company's ground. The company was incorporated in 1919 with a capitalization of $1,000,000 shares of the par value of $1 each. No work of importance has been done since 1919, when three tunnels were driven, which, however, did not find any ore of commercial value.

Spider Group.

The three claims comprising this group—*Spider*, *Spider No. 2*, and *Spider No. 3*—are situated at the north east end of Long lake and are owned by the original stakers, Bill Hamilton and Charlie Larson, two old time prospectors in this district. The country-rock is intrusive mass of augite porphyry, in which occur four or five small quartz veins mineralized with galena, zinc-blende, a little chalcopyrite, with silver sulphides and native silver showing on the seams. A tunnel 700 feet long was driven on one of these veins, encountering several lenses of good milling grade ore. High grade ore has been found in the croppings and I think the showings warrant further exploration. There was a good camp at one time, but it is now in bad condition. A small compressor and equipment were installed.

American Mining and Milling Co., Ltd.

This company is capitalized at $1,500,000, divided into an equal number of shares. The holdings of the company comprise the *Betty* group, the *Sunrise* group, the *Daly Sullivan* group, the *Lois Edith* group (all in the upper Salmon River valley), and the Georgia River Mining Company's property acquired this summer. In addition to these properties in British Columbia, the Fish Creek Mining Company's holdings on the Alaska side are also included in the company's property. I have not examined the Fish Creek showings and therefore have no information to offer as to the amount and nature of the work done and the results obtained. The *Betty* group was described in last year's report, and as the work done on it this year was very small there is nothing new to add.

Some surface work was done on the Georgia River claims exposing several small quartz veins, from which, according to the report issued, some good gold values were obtained. Further development may prove that a sufficient tonnage is available from several of these small veins to furnish a small capacity mill and make the property a profitable undertaking.

Cronholm-Bartholf Mines, Ltd.

This company was incorporated in December, 1922, with a capitalization of $250,000, divided into 250,000 shares, and is a specially limited company. Its holdings comprise eight mineral claims known as the *Hollywood* group, situated on the west side of Salmon glacier, north of the West fork of the glacier. The claims are *Hollywood Nos. 1* to *8*, inclusive, of which *Hollywood No. 7* is a fractional claim. A contract was let this summer for tunnel-work and I am informed that over 200 feet was driven. Some very high-grade ore in silver values has been found on the surface on a contact of argillite with the Coast Range granite.

Mr. Cronholm, who has charge of the operating of the property, says that about 400 feet of work will be necessary to reach his objective. Work will be started as soon as supplies can be taken in over the snow-crust in the spring.

A horse-trail was cruised out up the Salmon glacier to serve this and other properties west of the glacier, and indicated by markers consisting of a light wooden frame making four isosceles triangles, so that no matter which base it rests on the frame stands up about 8 feet high above the ice.

Eldorado Gold Mining Co., Ltd.

This company was incorporated in Seattle, Wash., and was registered in British Columbia in October as an extra-provincial company. Its authorized capital is $145,000 and its paid-up capital is $140,000. The head office is at 602 Securities Building, Seattle, Wash., and H. H. Gramm is secretary of the company. There are four claims in the property—*Almo*, purchased from Mr. Bartholf; *Eldorado* and *Silver Thought*, staked by T. V. Wilson and turned over to the company; and *Silver Thought*, staked by M. Nash and purchased by the company. The claims are situated on the west side of Salmon glacier, just south of its west arm, and are reached by a marked out trail up the glacier. The camp is at 3,400 feet elevation and the upper showing is 4,100 feet. The prevailing country-rock is argillite, lying very close to the Coast Range granite.

The upper showing consists of a small vein; in fact, two veins, which join at this point. The vein-filling is a decomposed material, in which are bunches of galena carrying considerable grey copper, picked samples of which assay up to 600 oz. silver to the ton. The average vein-matter will carry about $150 in gold and silver values, of which the gold assays up to $22 a ton.

The main vein here strikes N. 20° E. (mag.) and dips 50° to 60° E., while the cross-vein strikes about north-south and dips 50° W. There is another open-cut on the main vein, about 50 feet above, and it can be traced on the surface both above for a considerable distance and below the cut and tunnels. A tunnel was being driven on the main vein with the intention of crosscutting to the cross-vein when about 200 feet had been driven.

West of this vein a tunnel had been driven 60 feet, following a small decomposed vein similar to the above. This work will eventually intersect a large light-grey-coloured dyke, on the south side of which is a quartz vein showing galena. It is the intention of T. V. Wilson, who holds an interest in the property and is in charge of the work, to drive this tunnel through the dyke to the quartz and then explore the quartz vein by drifts.

East of the upper showing, just above the camp, another small high-grade vein has been exposed in a couple of open-cuts and will be further explored. The surface values obtained are very satisfactory, and if the oxidized vein-matter will make the same width of sulphides when further depth is obtained an appreciable tonnage will be available. Mr. Wilson is confident that he will develop a profitable property.

Yellowstone Group.

This group is owned by Bill Murphy, of Hyder, Alaska, and is one of the first locations in the Salmon valley. The original group was comprised of three claims—*Yellowstone*, *Bute*, and *Old Timer*—lying west of the *49* group and extending down to the glacier. A great deal of work had been done on this property in open-cutting and stripping, disclosing some fine showings of mineralization. On the survey of the *49* group a great portion of this work was found to be on the *49* ground.

This year the owner has started a tunnel about 100 feet above his cabin, exposing 8 feet of well-mineralized quartz and indicating a total vein-width of about 20 feet. A sample across the faced-up tunnel gave $8.40 a ton in gold. This ore, I judge, would concentrate about 8 or 10 into 1. On the foot-wall of this vein is some galena showing and coarse pyrite, resembling the high-grade ruby-silver ore in the *Oxidental* tunnel of the *49* group. Some work should be done on this vein to expose its full width. It strikes into the hill at N. 70° E. (mag.) and can be traced up the hill by its croppings, showing it to be the continuation of the main vein of

the *49* property. It has also been opened up by open-cuts for several hundred feet down the hill. It is a strong, well-defined, well-mineralized vein, and as such deserves opening up.

Several other veins have been found recently on these claims both paralleling and crossing the one mentioned, which, of course, need work to demonstrate their worth.

Forty-nine Mining Co., Ltd.

This company is capitalized for $1,500,000 in shares of $1 par value each. There are nine claims in the property, situated on the east side of Salmon glacier, near its head, about 23 miles from tide-water. In 1920 about 200 feet of underground work was done on the *49* and the tunnel on the *Oxidental* was driven 95 feet. There is a splendid surface showing on the *49*, but the underground work failed to develop any ore of importance. Further work should be done lower on the hill.

A little more work was done in the *Oxidental* tunnel and it is now in about 115 feet. The first 50 feet from the portal shows a vein up to a foot in width of high-grade ore. From there to the face there is no ore to amount to anything and the formation at the face is badly broken up.

A considerable tonnage of high-grade ore could be stoped above the tunnel. There are about 20 tons on the dump, showing bands of heavy sulphides carrying ruby silver, argentite, and some native silver. It is a property worth developing.

Hercules Mines, Ltd.

There are five claims in the company's holdings—*Glacier*, *Martha Ellen*, *Cornelius*, *Empire*, and *Leckie Fraction*. The property is now under option to Montreal interests, which did considerable work on the claims during the summer. The country-rock is a series of tuffs belonging to the Bear River formation. A large amount of work had been done on the property in the early days, mainly in open-cutting. Later a tunnel was driven under one of the most promising surface showings, proving it to be a superficial deposit. A shaft sunk on another promising outcrop also proved that the ore only extended a short distance downwards, the outcrops being patches of ore remaining after the erosion of apparently a flat vein.

The work this year was done on a fissure-vein striking north-south and dipping 65° W., known as the "Canyon vein," since it occupies the bed of a creek which has been eroded to a considerable depth in places. In all, eight open-cuts were put in this vein and a crosscut tunnel started and driven 35 feet on a N. 60° E. bearing toward cutting the vein, which would be reached in approximately another 135 feet. The vein was exposed by this open-cut work for about 400 feet; farther north and south it is heavily overburdened. The ore consists mainly of pyrite with galena and some zinc-blende in a quartz gangue.

A sample across 3 feet in one of the north end cuts gave $14.40 in gold, $3.80 in silver, and 17 per cent. lead. Another sample across 3 feet from a cut on the south end gave assays of $33.60 in gold to the ton, $1.30 in silver to the ton, and 1.7 per cent. lead. In the big cut on the north end of the exposed portion of the vein the vein shows a width of about 12 feet of fairly well-mineralized quartz. Altogether it is a strong showing and the values warrant obtaining some depth by the continuation of the crosscut tunnel to the vein.

Montana Fractions.

These lie just east of the *Hercules* group and are owned by H. McGuire and associates, of Stewart. Three quartz veins have been discovered, in which the mineralization is pyrites, some galena and zinc-blende, carrying values in gold and silver. One of these veins is over 15 feet wide, strikes N. 70° E., and is therefore a cross-vein to the *Hercules* vein. Another parallel vein is from 3 to 10 feet in width, and a third cross-vein between the first two, up from 6 to 12 feet in width, and parallels the "Canyon vein" on the *Hercules* ground. These three veins all crop in a country rock of quartz porphyry and are deserving of thorough prospecting.

Unicorn Group.

There are four claims in this group, belonging to John Hovland, of Hyder, Alaska. They lie east of the upper claims of the *Big Missouri* group. Messrs. Trite and Wilson took an option on this group at the time they bonded the *Big Missouri* and for two seasons carried on extensive surface exploration-work, but I understand they did not exercise their option and the property has therefore reverted to Mr. Hovland. As work had been closed down on this property at the time of my visit to that section, I did not have the opportunity of seeing what had been done by way of development.

The *Silver Hill*, *Silver Tip*, *Sunset*, and *Mineral Hill* groups, situated in the area just north-east of the *Big Missouri* have had no work of note done on them for the past two or three years.

Big Missouri Group.

(*See* previous Reports.) This property is under bond to Messrs. Trite and Wilson, former part owners of and still heavily interested in the *Premier*. A third payment was made at the end of the year, indicating that the year's development was satisfactory and giving reasonable assurance that it will be further explored. Operations were closed down in the summer and the machinery removed from the ground, which naturally gave the impression that results had not been sufficiently encouraging to warrant proceeding, and as a consequence the outlook for the upper Salmon valley was not particularly bright. The making of the payment, however, has put a new complexion entirely on the prospects of that area.

Work was started early in the spring under the supervision of Bob Wilson. A compressor plant was taken in over the snow and installed at the mine. Underground work was carried on in the old tunnel and a considerable amount (exact footage not obtainable) of diamond-drilling done.

In the absence of any one connected with the property I did not have the opportunity of seeing it this year, and have no authentic information as to the work done, results obtained, or the future policy of the bonders.

Indian Mines Corporation, Ltd.

(*See* 1922 and previous Reports.) This is a reorganization of the Indian Mines, Limited, whose original capitalization was $1,000,000 of the par value of $1 each; later, in 1922, increased to $1,600,000, divided into 1,600,000 shares. In July of this year (1923) the present corporation was formed with a capitalization of $3,000,000, divided into shares of the par value of $1 each, and with the registered office in Prince Rupert. The finances of the company are in good shape and are being handled in Montreal and Toronto. The holdings of the original company consist of four claims—*Portland No. 1*, *Portland No. 2*, *Big Dick*, and *Fritz*. To these have now been added by purchase the adjacent ground north, comprising the *Morn*, *A.M. Fraction*, *O'Brien Fraction*, and *Maggie Jiggs Fraction*. The original four claims and the *Morn* are Crown-granted and the remainder have been surveyed and Crown grants applied for.

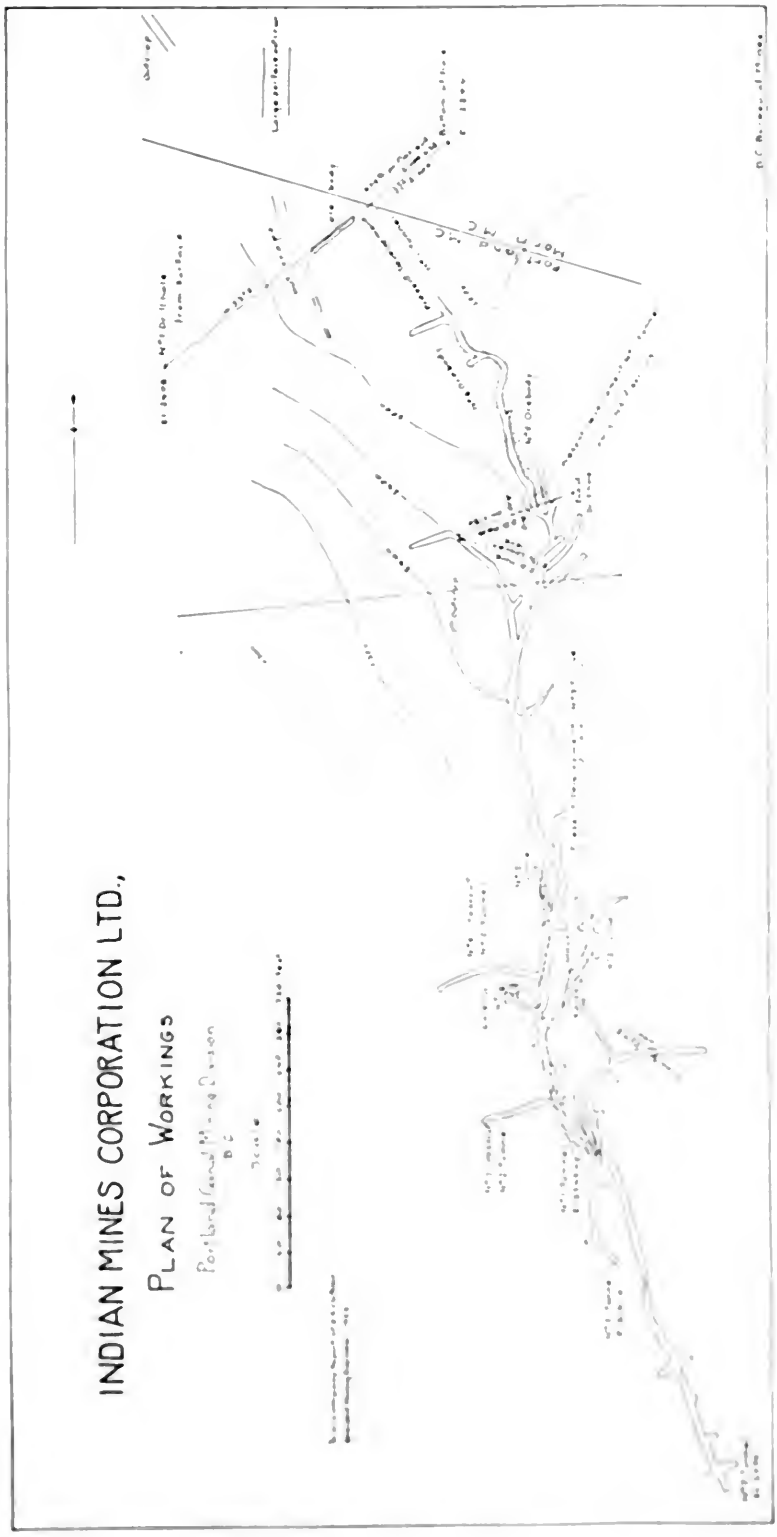
The property lies on the west side of Cascade creek, about 3½ miles by trail from the *Premier* wagon-road at 13-Mile. This year application was made for a wagon-road branching from the main road at 13-Mile, where the Canadian Customs-house is, to cross Cascade creek and serve all properties on the Missouri ridge. Toward this a high-level bridge was completed across Cascade creek early this winter, which is greatly facilitating the handling of freight. Last winter over 400 tons of freight was hauled in over a snow-road. Altogether this has been a very busy year and a great amount of work has been accomplished, not only in actual underground development, but in freight-handling, camp and plant construction, installation of plant and equipment, etc., as well.

Camp construction consisted of a new bunk-house and cook-house accommodating thirty-five to forty men, office, assay office, stable, etc. At No. 1 tunnel a blacksmith-shop, timber-shed, store-room, fan-house, etc., were built. Just above the camp a steel tank of 15,000 gallons capacity was set up for crude-oil storage and about 300 barrels of oil freighted in over the snow. At the lower tunnel a compressor building 24 by 48 feet was built and a 325-cubic-foot air-compressor and a 60-horse-power semi-Diesel engine installed, as well as a 6-horse-power engine and fan for ventilating purposes for the lower tunnel. The mine is equipped with Denver Rock Drill Company's machines, Matteson cars, with Hyatt bearings, steel, fans, etc.

The company owns its own freighting outfit, consisting of twelve horses, wagons, sleighs, double-enders, and six skinners. A freight camp was established at the end of the new bridge at Cascade creek, where a 30- by 40-foot barn, blacksmith-shop, store-house, bunk-house, and mess-house were constructed. All freight is now hauled on sleighs to this camp and there transferred to the double-enders for transportation up the hill to the mine. Barns are rented in Hyder, Alaska, for lower end of freighting outfit. At Stewart is the general office, with one man in charge looking after freight, etc.

There were about 2,000 feet of underground work done during the year, making a total of over 4,000 feet to date. In addition, there were 2,000 feet of diamond-drilling, two holes from the surface aggregating 1,000 feet, and six holes from No. 1 tunnel aggregating 1,000 feet.

The general rock formation in which the ore-bodies occur is quartz porphyry of the *Premier* type, intruded by many dykes, the porphyry itself intruding the tuffs and tuff conglomerates. The mineralized zone is about 60 feet in width, in which there are, so far as known, three main


INDIAN MINES CORPORATION LTD.,
PLAN OF WORKINGS

north-south fissures providing the main channels for mineralized solutions, and therefore, in general, carrying the main ore-bodies. There are several series of cross-fractures, the most important of which are N. 20° W., N. 10° E., and N. 30° E., which, within the mineralized zone, divert the ore-bodies from one north-south fracture to another, and in so doing are themselves mineralized and make a portion of the ore-body. In many cases the cross-fracture is only ore-filled for a short distance from its juncture with the main body, and it is therefore a difficult matter to know which fissure should be followed and adds greatly to the complication of development on each level. Further, the ore may be diverted from one fracture to another between levels, the result being that an ore-body on one level may not conform with that body on another level. Stoping may therefore prove a much greater tonnage than is now indicated by the separate ore-shoots, in that these shoots may connect in places to form a more or less continuous ore-body.

The main development-work of the year has been the No. 1 (or upper) tunnel. This at the end of this year had been driven 1,050 feet from the portal to the face, besides several hundred feet of crosscutting and lateral drifting on the cross-fissures. This work has disclosed six ore-bodies aggregating 630 feet in a total of 1,050 feet of straight drifting. The last two ore-bodies, Nos. 5 and 6, have only a short distance between them and may be considered probably as one shoot, having a length of 325 feet. The average width of the ore-bodies has not as yet been determined, but will vary from drift-width to 20 feet as shown in a crosscut through No. 6 ore-body. The average value of the ore, as shown by the mine-sampling records obtained by sampling the face after every round, and later checked by channel sampling, is $15.20 a ton in gold, silver, and lead values. The average zinc content is 8.5 per cent., which, with present separation methods, should be considered additional values.

Several small veins of high-grade ore have been encountered in development-work, occurring principally in the north-east series of fractures. However, in ore-bodies 5 and 6 short lenses up to 2 feet in thickness of ore, assaying up to $90 a ton in gold and high values in silver, were found in driving the main drift in the ore-bodies. While no exploratory work has been done on these lenses and cross-shoots, and therefore no tonnage developed, yet they are significant as indicating the possibilities of the occurrence of important high-grade ore-bodies as exemplified in the *Premier*.

A raise was put through from No. 2 tunnel to No. 1 and from No. 1 to the surface for ventilating purposes. The No. 3 (or lower) tunnel has been driven a total of 650 feet, of which 563 feet were done this year, bringing it nearly 100 feet beyond the portal of No. 1, 150 feet vertically higher. Some bunches and short lenses of ore were cut in this work, but no attempt at lateral exploration is being made, the objective being a point under the Nos. 5 and 6 ore-bodies in the No. 1 tunnel. The present indications in this tunnel are very promising.

Everything considered, the development to date has been very satisfactory and the property is in good shape. The amount of ore cut in one tunnel would seem to leave no doubt as to the ample tonnage available for milling purposes. Apparently the only question to be answered is whether a $15 (plus probably recoverable zinc values) milling-ore of this character can be made profitable. Thorough milling tests are being made of the ore and plans being formulated for the erection of a concentrator, power plant, etc.

G. D. B. Turner, of New York, who interested Montreal and Toronto capital in the property and has been the consulting engineer for the past two years, is to be commended for his efficient handling of the Indian Mines. R. L. Clothier is the manager at Stewart and has ably filled his part in the development of the mine.

Premier Extension Gold Mining Co., Ltd.

This company was incorporated at Ottawa, Ontario, with a capitalization of $4,000,000. It was registered as an extra-provincial company in February, with its office in the Winch Building, Vancouver. The company bonded from H. McGuire the *Vancouver* group of ten claims, owned by H. McGuire and associates, and the adjoining *Woodbine* and *Kitchener* claims, owned by C. Lake and Dave O'Leary. These claims are all situated on the west side of Cascade creek, just above Cascade bridge, and adjoin some of the lower claims of the *Premier* property. Some work had been done presumably on the *Woodbine* several years ago, but a survey of the Premier Gold Mining Company's claims showed this work to be on the *Premier* ground, which left the Premier Extension Gold Mining Company without a showing.

Early in the spring a temporary camp was put up and prospecting work started on the ground, with rather indifferent results until late in the fall, when a discovery was made near the upper line of the *Woodbine No. 2*, about 800 feet above the trail. This showing is reported as being a well-pyritized quartz vein, carrying gold and silver values, up to 20 feet in width. It was traced about 200 feet on the surface by open-cutting before the snow came, after which work was abandoned. On the property is the best three-story log cabin in the Salmon River valley, built just below the trail. It is fitted with every convenience for a mine camp, from wash, change, and dry room in the basement, dining-room and culinary department on the second floor, to sleeping-quarters on the top floor.

It is to be hoped that operations will be resumed in the spring, for this ground is a good prospecting area.

The *Pay Roll*, *Glacier*, *Puttemont*, and *Mineral Basin* groups, surrounding the *Indian* group, are owned respectively by Bill Murphy, of Hyder, Alaska; H. Scovil and partners, of Stewart; M. R. Jamieson and partners, of Hyder, Alaska; and Bill McGrew, of Hyder, Alaska. No work other than that necessary for assessment was done on any of them this year.

The *Fish Creek*, *Titan*, *Riverdale*, *Alaska Premier*, *Daly-Alaska*, and *Virginia* groups, all situated on the Alaska side, are reported to have had extensive development during the summer. I did not examine any of them and have no information as to results of development work. I understand that the *Riverside* is being worked all winter and it is reported that the property is showing up very well.

UNUK RIVER SECTION.

This section includes all the drainage-basin of the Unuk river east of the Alaska-British Columbia boundary-line. At present the only way of getting into this area is from Ketchikan and up the Unuk river from its mouth at tide-water at the head of Burroughs bay. A launch can go about 4 miles up the river, from which point a river-boat has to be used. By poling and lining the second canyon about a mile above, the boundary-line may be reached. From there supplies have to be portaged about 4 miles to the upper end of the canyon and chances taken of finding an old boat for further transportation up the river, which at best is very uncertain. The alternative would be to take in material with which to build a boat at the upper end of the canyon.

Let me impress it on intending prospectors in that area that they must know how to manage a river-boat or the one trip will be sufficient. The river is swift and dangerous, being deep in places and filled with snags and log jams.

The prospecting possibilities are the same as in the Salmon River valley, the rock formations and conditions being similar.

Two old Crown-granted properties—the *Daly* group, at the head of Sulphurite creek, and the *Globe* group, 12 miles up the South fork—were bonded this year.

It is hoped that negotiations with the Alaska Road Commission will be successful in having a trail or road constructed from the mouth of the river to the boundary, and from there continued on up the river by the British Columbia Government, to facilitate the prospecting and opening-up of this promising area.

STIKINE AND LIARD MINING DIVISIONS.

These two Divisions include all the northern portion of the Province, except the Atlin Mining Division in the north-west corner. The Stikine Division is the total area drained by the Stikine river, which empties into the Pacific ocean at Wrangell, Alaska. The Liard Division is the whole drainage-basin of the Liard river and is on the Arctic slope, the Liard river flowing into the Mackenzie river at Fort Simpson. The two Divisions represent the greatest area of unexplored country in the Province.

Surprisingly little has been learned of this vast area since Geo. M. Dawson and R. G. McConnell, of the Geological Survey, Canada, made their reconnaissance of it in 1887. These men started from Wrangell, Alaska, went up the Stikine river by boat to Telegraph Creek, from there to the head of Dease lake by pack-train, and from there by boat to the junction of the Dease river with the Liard at "Lower Post" of the Hudson's Bay Company. There they separated, Mr. McConnell going down the Liard to the Mackenzie river and Mr. Dawson going up the Liard and Frances rivers to Frances lake. From there a portage was made across to

the upper Pelly river, then down the Pelly to the Lewes, and up the Lewes and over the Chilkoot pass to the head of Lynn canal, a total distance from Wrangell of 1,322 miles.

Official sources of information show that the main placer-gold production in these two Divisions was from 1873 to 1880, from which time it has gradually dwindled to nothing.

An old day-book, date 1877–78, picked up at Laketon is interesting, showing commodity prices to compare very closely with present-day "civilized" prices. One item of especial interest charged Jim Brand with $1 for two drinks of rye, exemplifying the consistency of bootlegging and its prices.

This year, though there has been no production, has seen the greatest activity for many years. This has without doubt been due to the completion of the wagon-road from Telegraph Creek to Dease lake, 72 miles, by the assistance of the Mines Department. The first motor-cycle went over this road this fall.

Dease Lake Section.

The Pendleton Mining Company, operating leases on McDame creek, which empties into Dease river, took in 45 tons of heavy machinery with a tractor, relaying the freight as the road was completed. The machinery consists of a Sauerman combination scraper and bucket drag-line, used to great advantage in the Yukon for shallow diggings. The heaviest piece weighed about 2 tons. A small hydraulicking outfit has been taken into McDame creek by S. L. Wing, who says he will be operating next season.

The Dease Creek Mines Corporation, a Seattle company, registered in October as an extra-provincial company with a capitalization of $50,000, has a number of leases on the bar at the mouth of Dease creek and eleven leases on the creek itself. The Company operated a Star drill all season testing this ground under the supervision of F. W. Craig. The ground, it is claimed, has proven sufficiently rich to warrant the installation of a drag-line outfit, which the company expects to have in operation by August, 1924.

Messrs. Ball, Finn, and Quinn have been working all season on their 900-foot bed-rock flume on Deloire creek, a tributary of Thibert creek. The high water in the spring filled in a lot of their flume, which, of course, necessitated a lot of dead-work. They carried on the work all this winter, driving ahead about 140 feet, and estimate that another 75 feet, which they expect to complete by spring, will put them in to bed-rock. This completed, sluicing can be gone ahead with, and judging by what is known of the bed-rock, with every chance for success.

The Dease Syndicate, comprised of George Adams and associates, of Victoria, hold 3 or 4 miles of leases along the south bank of Thibert creek from Deloire creek westerly. Mr. Adams has been hydraulicking for the past two or three years until this year. This work has demonstrated the values on bed-rock and has also conclusively proven that in order to realize any profits more ground must be treated. This calls for more water and heavier plant and Mr. Adams has been endeavouring this summer to interest capital for the installation of the necessary plant. He has made a very detailed and comprehensive report on the property and estimate of cost of new plant. An examination of the property will be made as early as possible in the spring by Eastern interests. There is no doubt as to the merits of the enterprise, and since the completion of the wagon-road the greatest handicap against the installation of adequate plants in that country has been removed.

Some prospecting was done this year in the vicinity of McDame creek and the old Haskins property restaked and recorded by A. Brindle, a mining engineer from Victoria.

Stikine River Section.

Some little prospecting was done this summer along the Stikine river, particularly around the "Devil's Elbow," but with what results I do not know. This, in my opinion, is one of the most favourable and accessible sections in my District for prospecting, although, strange to say, very little of it has been done.

The eastern border of the Coast Range granite is given by Dawson as crossing the river about Kloochman canyon, just below Grand rapids. From this point north along the river is the Eastern Contact Belt, similar to that in the Alice Arm-Stewart sections, with equal chances for ore-bodies. I venture to say that none of the hills have been prospected a mile back from the river, and, in fact, comparatively little close along the river. A prospector will be landed anywhere along the river by the Barrington Transportation Company river-boat, plying from

Hydromagnesite Deposit, Atlin, Atlin M.D.

Fourth of July Creek, Atlin M.D.

Wrangell to Telegraph Creek once a week, with his supplies and outfit, and he can start prospecting where he lands. If he discovers anything transportation is right there.

ISKUT RIVER SECTION.

I made a trip up the Iskut river, a branch of the Stikine, with the object of getting through to the head of the canyon to ascertain whether there is a trail route through from the Iskut to the head of the Unuk river. Unfortunately the creeks were running wild, due to heavy rains, and it was impossible to make through in the limited time I could take for the trip. From the mouth of the river to the South fork, about 30 miles, is good water, but from there to the foot of the canyon is very swift. It took us four days to go up from the mouth of the river to the foot of the canyon and four hours to come down.

The South fork marks the eastern contact of the Coast granites, and from there up the river is the typical greenstone formation of the Alice Arm-Stewart sections. I judge it to be about 10 miles from the South fork to the foot of the canyon, which consists of a lava-filled valley for about 20 miles, over which is an easily followed foot-trail.

To make the country accessible for exploration there should be a trail built from the South fork along the south side of the main river up to the canyon, thus avoiding the swift water and making the upper country accessible regardless of the stages of water. Also from the South fork to the mouth of the river could be greatly improved by removing the snags and log-jams.

About forty claims were staked and recorded on the Iskut in 1923.

ATLIN MINING DIVISION.

TAKU RIVER SECTION.

This section is the drainage area of the Taku river, which flows into the head of Taku Inlet, which in turn opens up into Stephens passage, about 16 miles south of Juneau. The inlet is about 18 miles long to the mouth of the river at Bullard's ranch and from there to the boundary is about 10 miles, or about 45 miles from Juneau to the boundary.

The Taku river is navigable for small gas-boats up to the mouth of the Sloko, flowing in from the north. The eastern border of the Coast Range granites I judge is between 10 and 12 miles above the boundary. This point on the Eastern Contact Belt is approximately 230 miles north of Stewart on the same mineral-belt.

Several claims and groups have been staked in this section and some exploratory work done.

Tulsequeh Chief Group.—This group consists of seven mineral claims—*Tulsequch Chief*, *Tulsequch Bonanza*, *Tulsequch Fraction*, *Tulsequch Bald Eagle*, *Hemlock*, *Alpine*, and *Riverside*—owned by W. Kirkham, Geo. Johnson, and A. K. Smith, of Juneau, Alaska. The claims are situated on the east bank about 10 miles up the Tulsequeh river, which flows into the Taku river about 28 miles from its mouth. The Tulsequeh (Tailsaykway on the map) is navigable by small gas-boat for some distance beyond this. The Alaska Juneau Mining Company, of Juneau, Alaska, had the property under bond this summer and had four to six men on development-work. It is the first property bonded in this section.

The general rock formation appears to be an andesitic or greenstone schist; therefore about the same as the Bear River formation of the Stewart area. The showing is a heavily pyritized quartz vein, also carrying chalcopyrite, galena, and chalcocite, with a banded structure paralleling the walls. The vein overlies a light-coloured, fine-grained rhyolitic dyke and strikes N. 30° W. (mag.), with a dip of from 30° on the foot-wall to 60° S.W. on the hanging wall, with the slope of the hill. The hillside has a general bearing of N. 50°–60° W. and the vein and dyke therefore gain in elevation going north and cut diagonally down the hill toward the river going south. The camp is on the river-bank.

A tunnel at 1,400 feet elevation above the camp had been driven 30 feet, cutting diagonally across the vein from the hanging-wall. The first 18 feet is a schistose rock showing a slight mineralization of pyrite, the balance of 12 feet showing seams of mineralized quartz and seams of pyrite. If the vein is 25 feet in width here, the crosscut tunnel would have to be driven about 40 feet altogether to reach the foot-wall.

About 90 feet above this tunnel an open-cut about 12 to 14 feet long had been driven across a portion of the vein to the foot-wall, showing good ore all the way, in which were bands of good chalcopyrite. About 500 feet north of this open-cut, at 1,920 feet elevation above camp,

the dyke outcrops again. A little work here shows about 12 feet of andesite on the dyke; then about 12 feet of heavily pyritized vein-matter.

Samples of the best copper ore gave assays of 23.7 per cent. copper, $4.55 gold to the ton, and 18.08 oz. silver to the ton. A sectional sample across 24 feet gave an average value of $6 gold to the ton and 14.11 oz. silver.

I have later been informed by the company that the results of the subsequent work did not meet expectations; therefore it had not taken up the bond on the property. Notwithstanding this, the discovery of veins of this size, though carrying low values for present conditions, is indicative of the possibilities of this section and should encourage further prospecting.

Rainy Hollow Section.

(*See* Gold Commissioner's Report following.)

So far as I have been able to ascertain, there has been nothing done in this section this year. The *Maid of Erin* property, which was under bond to and being operated by Robert Wiley, of Seattle, had been well equipped and considerable development-work done on it before it became mixed up in litigation last year, since which time everything has been at a standstill.

Atlin Lake Section.

The yield of placer gold this year, according to the figures furnished me by C. L. Monroe, Gold Commissioner, was $156,500, slightly less than last year, but about the normal output. There seems to be very small chance that there will ever be any great increase in the present output. The continuation of the pay-streak up Spruce creek will ensure the life of the camp for several years. To this end, recommendation was made last year to the Mines Department that the Government construct a bed-rock drain up Spruce creek to a point where the present owners of the creek leases could extend it through their ground to their upper boundary. By this system each owner would be responsible for the extension and maintenance of the drain through his ground and every one's ground drained without interference with any one's workings.

On Ruby creek the Placer Gold Mines Company had a very successful season, but unfortunately the company's ground will be exhausted in another season's work.

T. H. Williams was prospecting the ground above, the object being to get to bed-rock in the old channel under the lava-flow. At the time I was there (June) a shaft had been sunk at the edge of the present creek-bed, through 18.5 feet of lava, 6.5 feet volcanic ash, and then through 34 feet of gravel to bed-rock, which here proved to be the rim of the old channel and showed colours. The shaft was fitted with a Cornish pump handling 30 gallons a minute. It was the intention at that time to crosscut under the lava, following the rim to bed-rock of old channel. If the pay proved satisfactory, a drain was to be started 500 feet farther down the creek and brought up to the bottom of the shaft, which would make the 1,500 feet of ground above easy to handle. No information has been given me as to the results of the work.

Geo. Adams has a lease on the McKee Creek hydraulicking outfit and will operate there himself next season.

Engineer. I visited the property in the latter part of June. At that time operations had not been started and no definite plans known for the future. Some time later A. Sostad was put in charge of development-work for New York interests. The crosscut tunnel started just above the lake, and driven some distance by the late Captain Alexander toward the bottom of the shaft on E vein, is being advanced and is reported to have cut one of the four expected cross-veins showing on the surface. Work is being carried on all winter. It is to be hoped that the property will be allowed to operate clear of litigation, with which it has been cursed since Captain Alexander's death on the "Princess Sophia."

Big Horn Group.—(*See* Report, 1921.) Fred Lawson, the owner, has been working on this property all season, but nothing new has been reported.

Atlin Silver-Lead Mines. (*See* 1922 Report, and 1921 Report under heading of *Big Canyon* and *Ruffner* groups.) This property on Fourth of July creek is being operated by J. M. Ruffner, of Atlin. There are fifteen claims in the property, of which there is a plan-map in each of the 1921 and 1922 Reports. The development-work for this year consists of the sinking of the shaft at 2 C surface showing on the *Cherakee* to a depth of 50 feet and a drift north from the bottom for 40 feet. On the surface at this point the vein shows a width of 14 feet of badly oxidized material, in which are residual lumps and

ribs of galena. Going down the shaft, places can be seen where there are from 1 to 4 feet of ore in width. Lower in the shaft a hanging-wall vein developed, showing a considerable mineralization of chalcopyrite and heavy in zinc-blende. So far as can be seen the bottom of the shaft is not on the hanging-wall yet. Here a crosscut was driven back to the foot-wall granite a distance of about 9 feet, showing about 2 feet of mixed material on the foot-wall, and then from 1 to 4 feet of ore consisting of galena, zinc-blende, and oxidized material. About 10 tons of ore had been shipped from this work and about 25 tons remained on the dump, which could be sorted to about half that amount of shipping-ore.

The 40-foot drift from the bottom of the shaft shows from 12 to 18 inches of good ore all along, which in places is solid galena. A crosscut to the left at the face of the drift had cut the copper vein, but had not yet reached the hanging-wall. Along the bottom of the drift there are about 4 feet of good-looking ore.

Altogether there is a marked improvement over the surface at the depth obtained, in that the sulphides are replacing the heavily oxidized material. I think there is no doubt that this improvement will continue as further depth is obtained and the leached surface zone got away from. A gradual increase of gold values in depth has been noted.

This year 12 tons of ore was shipped to the Tacoma smelter, which gave returns of: Gold, 1 oz.; silver, 1,008 oz.; copper, 188 lb.; lead, 10,782 lb.

A sample of the pure galena from the face of the drift assayed: Gold, $8 to the ton; silver, 145.8 oz. to the ton; lead, 78.7 per cent. A sample of the copper vein assayed: Gold, $1.00; silver, 158.8 oz. to the ton; copper, 10.3 per cent.; lead, 11.7 per cent.; zinc, 9.6 per cent.

Very little was done on the property during the summer and up to the end of October, when R. F. Hill was put in charge. Since then a stable for four horses and a 14- by 14-foot assay office have been built at the camp, where there is a commodious log bunk-house and mess-house. At the foot of the hill another stable was built and a 14- by 14-foot log cabin. At the shaft a new hoist and compressor-house was built, and an 8- by 6-inch Ingalsdell compressor with gas-engine and a 6-horse-power Fairbanks-Morse hoist installed. A new 14- by 14-foot blacksmith-shop, a 12- by 12-foot ore-sorting house, and snow-shed over the dump were also built. An equipment of a new Ingersoll-Rand wet jackhammer with column, a stoping drill, steel, hose, extras, powder, gasolene, etc., has been laid down at the shaft, and it is expected that the work of deepening the shaft and extending the drift will be resumed about the first of the new year. A new winter road was cruised and is being slashed out from the foot of the hill at the mine to Atlin lake.

Altogether the property is in first-class shape to go ahead with development and make shipments as the work progresses. It is a very promising property and gives every reason for belief in its ultimate success, which will have a far-reaching effect on lode mining in this northern section.

I wish to thank the prospectors and operators throughout my district for their assistance and many courtesies.

CASSIAR DISTRICT.

ATLIN MINING DIVISION.

REPORT BY C. L. MONROE, GOLD COMMISSIONER, ATLIN.

I have the honour to submit the office statistics of the Atlin Mining Division for the year ended December 31st, 1923.

Free miners' certificates (individual)	264
Free miners' certificates (company)	3
Placer records	11
Placer rerecords	115
Leases applied for	9
Leases issued	4
Certificates of work (leases)	106
Leaves of absence (representing 66 claims)	24
Filings (placer)	8
Bills of sale, etc. (placer)	14
Bills of sale, etc. (hydraulic)	9
Bills of sale, etc. (mineral)	7
Mineral records	21
Certificates of work (mineral)	91
Certificates of improvements	1
Filings (mineral)	8
Crown grants issued	1
Gold reported or estimated	$142,000 00

Revenue.

Free miners' certificates	$ 1,515 00
Mining receipts, general	6,961 50
Receipts from all other sources	16,907 05
Total	$25,583 55

STIKINE AND LIARD MINING DIVISIONS.

REPORT BY H. W. DODD, GOLD COMMISSIONER, TELEGRAPH CREEK.

I have the honour to submit the office statistics of the Stikine and Liard Mining Divisions for the year ended December 31st, 1923.

Free miners' certificates issued (individual)	120
Mining receipts issued	110
Mineral claims recorded	75
Placer claims recorded	8
Placer leases issued	23
Certificates of work issued	14
Agreements and transfers recorded	28
Fllings	5

Revenue.

Free miners' certificates	$ 528 25
Mining receipts	1,776 90
Other sources	6,855 51
Total	$9,180 66

SKEENA DISTRICT.

SKEENA AND BELLA COOLA MINING DIVISIONS.

REPORT BY T. W. HERNE, GOLD COMMISSIONER, PRINCE RUPERT.

I have the honour to submit the office statistics of the Skeena and Bella Coola Mining Divisions for the year ended December 31st, 1923.

Free miners' certificates issued	333
Special free miners' certificates issued	1
Mining receipts issued	161
Mineral claims recorded	105
Certificates of work issued	154
Filings	9
Certificates of improvements granted	5

Revenue.

Free miners' certificates	$1,494 50
Special free miners' certificates	15 00
Mining receipts	1,677 40
Total	$3,186 90

NASS RIVER MINING DIVISION.

REPORT BY JOHN CONWAY, MINING RECORDER, ANYOX.

I have the honour to submit the office statistics of the Nass River Mining Division for the year ended December 31st, 1923.

Free miners' certificates (individual)	213
Free miners' certificates (company)	3
Free miners' certificates (special)	1
Mineral claims recorded	120
Certificates of work issued	355
Bills of sale, etc. recorded	40
Filings	22
Certificates of improvements recorded	12

Revenue.

Free miners' certificates	$1,285 75
Mining receipts, general	2,887 85
Total	$4,173 60

PORTLAND CANAL MINING DIVISION.

REPORT BY J. P. SCARLETT, MINING RECORDER, STEWART.

I have the honour to submit the office statistics of the Portland Canal Mining Division for the year ended December 31st, 1923.

Free miners' certificates (individual)	372
Free miners' certificates (company)	8
Free miners' certificates (special)	4
Mineral claims recorded	626
Certificates of work issued	914
Bills of sale, agreements, etc., recorded	245
Certificates of improvements recorded	22
Filings	76
Abandonments	32

Revenue.

Free miners' certificates	$ 2,759 00
Mining receipts, general	13,616 80
Other sources	1,900 00
Total	$18,275 80

QUEEN CHARLOTTE MINING DIVISION.

REPORT BY J. L. BARGE, MINING RECORDER, QUEEN CHARLOTTE.

I have the honour to submit the office statistics of the Queen Charlotte Mining Division for the year ended December 31st, 1923.

Free miners' certificates issued	50
Certificates of work (quartz) issued	45
Certificates of work (placer) issued	6
Placer leases recorded	1
Bills of sale, transfers, etc., recorded	16
Notices to group	1

Revenue.

Free miners' certificates	$232 75
Mining receipts	238 35
Total	$471 10

NORTH-EASTERN MINERAL SURVEY DISTRICT (No. 2).

REPORT FOR YEAR 1923.

BY JOHN D. GALLOWAY, RESIDENT MINING ENGINEER.

INTRODUCTORY.

The North-eastern Mineral Survey District consists of Omineca, Cariboo, Quesnel, and Peace River Mining Divisions, and occupies a large portion of Northern British Columbia, having an area of nearly 100,000 square miles. The northern, western, and southern boundaries of this district are the arbitrary boundary-lines of the Mining Divisions, but these, where practicable, always follow the watersheds of the country. The eastern boundary is the British Columbia-Alberta boundary-line. The western boundary is roughly 100 miles from the Coast, while the northern and southern boundaries are about 200 miles from the respective Provincial boundaries.

For descriptive purposes in this report the district is reviewed under the main headings of the Mining Divisions, subdivided into sections as follows:—

Omineca Division—Skeena section; Hazelton section; Telkwa section; Burns Lake section; Sibola section; Manson section.

Cariboo Division—Barkerville section; Fort George section.

Quesnel Division—Quesnel section; Quesnel Lake section; Horsefly section; Keithley section.

Peace River Division.

A general description of the geographic, geologic, and topographic features of the district was given in the Annual Report of the Minister of Mines for 1917. In the following table is given a list of the more important reports on this district, in addition to which numerous references can be found in the Summary Reports of the Geological Survey and the Annual Reports of the British Columbia Department of Mines:

LIST OF REPORTS ON DISTRICT.

Name of Author.	Publication.	Year.	Page.
Dr. Geo. Dawson	Geological Survey of Canada	1875	233
Dr. Geo. Dawson	Geological Survey of Canada	1876	17
Dr. Geo. Dawson	Geological Survey of Canada	1879	Pt. B
Dr. Geo. Dawson	Geological Survey of Canada	1888	73B
Amos Bowman	Geological Survey of Canada	1887–8	Pt. C
R. G. McConnell	Geological Survey of Canada	1894	5c
W. Fleet Robertson	Minister of Mines' Report	1905	89
W. Fleet Robertson	Minister of Mines' Report	1906	101
W. Fleet Robertson	Minister of Mines' Report	1908	66
W. Fleet Robertson	Minister of Mines' Report	1911	85
W. Fleet Robertson	Minister of Mines' Report	1912	65
W. W. Leach	Geological Survey of Canada, Summary Report	1906	35
W. W. Leach	Geological Survey of Canada, Summary Report	1907	19
W. W. Leach	Telkwa River and Vicinity, Geological Survey	1907	
W. W. Leach	Geological Survey of Canada, Summary Report	1908	41
W. W. Leach	Geological Survey of Canada, Summary Report	1909	61
W. W. Leach	Geological Survey of Canada, Summary Report	1910	91
G. S. Malloch	Geological Survey of Canada, Summary Report	1911	92
R. G. McConnell	Geological Survey of Canada, Summary Report	1912	55
G. S. Malloch	Geological Survey of Canada, Summary Report	1912	69
G. S. Malloch	Geological Survey of Canada, Summary Report	1912	103
C. F. J. Galloway	Minister of Mines' Report	1912	118
W. M. Brewer	Minister of Mines' Report	1914	101
John D. Galloway	Minister of Mines' Report	1914	176
J. D. MacKenzie	Geological Survey of Canada, Summary Report	1915	62
Chas. Camsell	Geological Survey of Canada, Summary Report	1915	70
John D. Galloway	Minister of Mines' Report	1916	134

LIST OF REPORTS ON DISTRICT—*Continued.*

Name of Author.	Publication.	Year.	Page.
John D. Galloway	Minister of Mines' Report	1917	86
John D. Galloway	Minister of Mines' Report	1918	107
B. R. MacKay	Summary Report, Part B, Geological Survey	1918	39
J. J. O'Neill	Memoir 110, Geological Survey	1919	....
B. R. MacKay	Summary Report, Part B, Geological Survey	1919	36
John D. Galloway	Minister of Mines' Report	1919	96
J. C. Gwillim	Oil Survey, Peace River Dist., Depart. of Lands	1920	....
John D. Galloway	Minister of Mines' Report	1920	79
John A. Dresser and Edward Spieker	Oil Surveys, Peace River Dist., Depart. of Lands	1920	....
Leopold Reinecke	Memoir 118, G.S.C.	1920	....
F. H. McLearn	Summary Report, Part B, G.S.C.	1920	1
R. W. Brock	Summary Report, 1920, Part A, Geological Survey	1920	81
John D. Galloway	Minister of Mines' Report	1921	89
W. A. Johnston	Summary Report, Part A, Geological Survey	1921	59
John D. Galloway	Minister of Mines' Report	1922	95
W. A. Johnston	Summary Report, Part A, Geological Survey	1922	68
W. L. Uglow	Summary Report, Part A, Geological Survey	1922	82
F. H. McLearn	Summary Report, Part B, Geological Survey	1922	1

GENERAL SUMMARY.

The year 1923 has been one of satisfactory progress for the mining industry in the Northeastern District. Judged by production the record is not striking, but the important development-work carried out and the results attained make future production in considerable quantity only a question of time. It should be remembered that as a rule the bringing of a mine to the productive stage is a work of years. Even the famous *Premier* mine after it was staked was developed for several years before it became a shipper.

The activity of 1922, which commenced after two years of comparative inaction, was very greatly increased during the year 1923. In lode-mining the outstanding feature of the year has been the activity shown in acquiring properties in the district by the Federal Mining and Smelting Company, a subsidiary to the American Smelting and Refining Company, which latter is the parent company of the Guggenheim organization. The potential possibilities of the district having thus been recognized by this important mining company, undoubtedly many others will follow its lead.

Early in the year the Federal Company took over the control of a group of some fifteen claims on Dome mountain which had been slightly developed in 1922 by the Jefferson syndicate. Since then other of the adjoining claims have been purchased and steady work has been kept up with a crew of about sixty men. The results of development done have been highly satisfactory. In July the mines of the Duthie Mines, Limited, consisting of three properties on Hudson Bay mountain, were acquired by the Federal Company, a 45-per-cent. interest being retained by the previous owner, J. F. Duthie, who had taken over the properties from the original owners and had partly developed them. Continuous operations have been carried on since that time. In September two other groups of claims at Owen lake, 26 miles from Houston, were bonded by the Federal Company and work was commenced shortly after. The showings are encouraging and the possibilities are for a considerable tonnage of medium-grade ore. Late in the fall an option on the *Lucky Jim* group near Usk was taken up by the same company, but it was not considered practicable to commence development until the spring. Options on other properties are also being considered by the company. Scouting-work for the company was carried on during most of the season by C. J. Curtin and to some extent by Henry Lee, superintendent of the Dome Mountain operations, so it is quite evident that the officials of the company consider the field a promising one for mining investment.

As soon as Mr. Duthie sold out his control of the Duthie mines he put two engineers looking for other properties to take up. In a short time he bonded the *Hyland Basin* group on Driftwood creek and immediately started a small crew at work. In November he secured an option on the *Fiddler* group, 5 miles from Dorreen. Work was started there under adverse weather conditions, so that by the end of the year but little more than camp-construction had been accomplished

Early in the summer an option was taken on the *Sultana* group on Boulder creek by the Granby Company. A diamond-drill outfit was taken in and one short hole put down. The information from this hole and some surface-stripping was apparently not encouraging and the company gave up the option. There is a good surface showing on the property and it seems more than likely that further exploration will be carried out by the owners next summer.

Small-scale work was carried out at a number of places throughout the district and in several instances this was quite satisfactory. The development on the *Sunrise* near Hazelton was sufficiently encouraging to warrant the management in deciding to run a crosscut tunnel which will be 1,000 feet long and should cut several veins. A small gas-driven compressor plant will be taken in during the winter and the driving of the tunnel will be commenced early in the spring.

The activity on the Duthie mines caused a mild stampede of claim staking on Hudson Bay mountain and a revival of prospecting operations. A very steady year's work was put in by Donald Simpson, owner of the *Victory* group, and he now has a likely looking property.

In the Driftwood Creek section of the Babine range, besides prospecting and assessment work at various points, development was carried on at the *Silver King*, *Hyland Basin*, *Little Joe*, and *Driftwood* groups and the property of the Babine-Bonanza Company (Cronin's mine).

In the Skeena section of the district work was carried on at a number of properties in the vicinity of Usk and on some at the head of Legate creek. In the Hazelton section the properties on Rocher Déboulé mountain and the *Silver Standard* mine remained inactive all year.

The property of the Telkwa Collieries Company was again operated, a working option having been obtained by J. McNeil, of Telkwa. A promising seam of coal on Goat creek which had not previously been worked by the company was opened up, a road built, bunkers erected, and the seam sufficiently developed, so that shipments of coal were commenced late in the fall. This coal is hauled about 5 miles to Telkwa in wagons or sleighs and sold to the local and Prince Rupert markets.

In the Cariboo end of the district placer-mining was carried on as usual, and, despite the handicap of a very dry year, with consequently very little water for hydraulicking, the production was slightly higher than last year. In the Cedar Creek area a temporary set-back occurred when the Cedar Creek Company went into the receivers' hands. In a short time, however, things were straightened out and operations were recommenced. There is a considerable amount of "rich ground" on the company's property, but as it is difficult to handle, owing to shortage of water, careful mining is required. A lot of work was done in this area by many individuals and small companies and some new finds have been made. It is evident that the country around Quesnel lake and the upper parts of the Quesnel river has only been slightly prospected and that a very considerable gold production will be made from it within the next few years.

In the Barkerville section an extensive drilling campaign was carried on by W. A. Thorne, representing English capital. He has been successful in proving a sufficient yardage of dredging ground to ensure the erection of a dredge, and it is expected the construction will be started in 1924.

In the Peace River Mining Division placer-mining operations are being carried on at several points along the Parsnip and Peace rivers. The gold is very fine and some difficulty is found in saving it, but better success is expected in the future. This Division has a great potential asset in the existence there of a large field of very high grade coal. One seam which has been proven to some extent has coal running from 75 to 80 per cent. fixed carbon and only 2 to 4 per cent. ash. This is a semi-anthracite which is an excellent steam coal or domestic fuel and practically smokeless. When this Division is supplied with railway transportation this coal will, owing to its high quality, undoubtedly find a ready market.

Summing up, it may be said that the year 1923 has been one of the best in the history of the North-eastern District. The mining industry here is on a solid basis, and while the actual production for the year is as yet small, the promise for the future is most encouraging. At the present time the district presents most favourable opportunities for the investment of mining capital and also an excellent field for the prospector.

ROAD AND TRAIL CONSTRUCTION.

Substantial aid to the mining industry was given by the Mines Department by means of grants from the Mines Development Fund to build, or partially assist in building, various roads

and trails in different parts of the district. This work is very necessary, as one of the greatest physical difficulties in mining in the district is in overcoming the transportation problems. The liberal attitude of the Government in this respect has had a marked effect in inducing companies to take up properties in the district.

The most important piece of road-construction during the year was the reconstruction of the road to Hudson Bay mountain. The old road to this section was laid out years ago as a sleigh-road and it was always evident that it would never be a suitable wagon-road for heavy ore shipments. The operations at the Duthie mines, entailing the hauling of heavy machinery in and ore out, put this road out of commission, and it was decided that it was better policy to build a new road rather than to attempt to repair the old one, as it would never prove suitable. On this reconstruction-work a considerable sum was spent, but a first-class road was built. This road serves a large district in which there are many mineral properties, including the Duthie mines. The mining company spent $10,000 in building 2 miles of road to connect with the Government road. Steady ore shipments have been made over the road both by tractor and team haulage.

Seven grants ranging from $100 to $750 were made in the Omineca Division to build or improve short pieces of roads and trails to aid prospectors and small operators.

In the Cariboo Division four grants, totalling $8,000, were made to build and improve roads and trails. Most of this money was spent in the Quesnel Lake section, where the Cedar Creek camp is situated. This work was justified by the large amount of work which was going on in this section and where improvements to the transportation were absolutely necessary. With the money spent last year (1922) and this year by both the Public Works and Mines Departments, this part of the Cariboo District is fairly well served with suitable roads, most of which are good enough for motor-cars.

PRODUCTION.

Approximately 950 tons of ore was produced by the Duthie mines during the year; this is a partially hand-sorted product and will run about 180 oz. silver and 22 per cent. lead. Most of this ore was hauled to Smithers before the end of the year, but not all of it was shipped, as the practice is to hold the ore until a shipment of six to eight cars is ready for shipment. In the development of other properties much ore has been taken out, but it is not known that any other shipments have been made.

The placer-gold production of the North-eastern District for the year was $216,000 an increase of $18,200 as compared with 1922.

Four hundred and seventy tons of coal was shipped by the Telkwa Collieries Company.

OPPORTUNITIES FOR PROSPECTING.

In the 1921 Annual Report, under the subheading "Prospecting Possibilities," was given an outline of the promising areas of the North-eastern District for prospecting. It is unnecessary to repeat what was said then, as any one interested can look up the 1921 Report, but a few remarks to emphasize the great possibilities for the prospector in this district may not be amiss.

In considering the North-eastern District for prospecting opportunities, it will be well to consider, first of all, what has been done, beginning with lode-mineral prospecting. The important part of the district for lode-mining activity has been in those parts of the Babine, Bulkley, and Coast mountains lying within the district, that have been made accessible by transportation, particularly by the Grand Trunk Pacific branch of the Canadian National Railways. In other words, the territory tributary to the Skeena and Bulkley valleys has been the scene of the greatest amount of prospecting and active mining. In this area, extending along the railway-line from Terrace to Houston, prospecting has been done at various points, and it might have been concluded that in the past fifteen years it has been quite thoroughly and sufficiently prospected. It is not, however, now believed that such is the case. A large part of the eastern contact zone of the Coast range of mountains in this district has never been prospected, and it is well known that this zone is a favourable place in which to expect to find commercial ore-bodies. Certain parts of the Babine and Bulkley mountains have been intensively prospected, but much larger portions of them have received but scant attention from the prospector. The name "Bulkley mountains" may not be familiar to all; it was adopted in 1917 by the Geographic Board of Canada to designate a semicircular group of mountains extending from Terrace to Houston and lying to the south of the railway, which neither geologically nor topographically

can properly be merged with the Coast mountains, but which forms an integral part of the Pacific system. The Bulkley mountains include the Zymoetz range, the Seven Sisters group, Rocher Déboulé group, Hudson Bay mountain, and other unnamed mountains.

As illustrations that this area is unprospected, it may be mentioned that the territory drained by the Zymoetz river, which lies wholly within the Bulkley mountains, was run over and slightly prospected in the years prior to railway-construction, but in recent years it has been left to the trapper. Similarly, areas in the Babine range which were explored years ago are now lying dormant and the claims staked allowed to lapse. What is needed is a fresh influx of prospectors who will prospect anywhere in the district and not confine their activities to certain areas. It is assumed, of course, that areas which were slightly explored some years ago are not, in any proper sense of the word, prospected.

It is interesting to note that the great majority of the claims that are staked in the Hazelton-Telkwa sections of the district are situated above timber-line, whereas most of the properties that are being developed at present, or have produced ore in the past, are situated below timber-line. While it would be unwise to draw too rigid conclusions from this, it is at least safe to say that the country below timber-line is at least as good prospecting country as that lying above. It follows, therefore, that there is a large area lying below timber-line in the Hazelton-Telkwa section that should receive further attention from the prospector. It is, of course, realized that searching for the outcrops of ore-bodies below timber-line is more arduous than above, and that more "digging" than "looking" is required, but nevertheless the prospector may be well repaid for the extra labour.

Enough has been said to show that in the most active lode-mining portion of the district there is still plenty of opportunity for the right kind of prospector. And if absolutely fresh fields are wanted, there is also plenty of room in the area to the north of the railway-line.

From Hazelton the railway-line runs in a general direction east by south right through the district to the Alberta boundary-line. Beyond Houston, which may be regarded as the eastern limit of the Babine range, the railway goes through the Nechako plateau, which extends for some distance beyond Prince George. In this area more or less prospecting has been done in places, but up to the present time the results have not been as satisfactory as in the more mountainous region to the west. In the Prince George section a number of properties have been slightly developed and some of them may become productive. In this section there are numerous quartz veins and it is quite possible that more careful prospecting will reveal some that are sufficiently mineralized to be of value. Lying to the south of Prince George are the placer-fields of the Cariboo, which are for the most part in the plateau region. The Cariboo part of the district has been much prospected and more will be said of this in discussing prospecting for placer. In passing, it may be mentioned that quartz veins are very plentiful in the Cariboo and many attempts to make them productive have been made. As undoubtedly these quartz veins were the original source of the placer gold, it is quite probable that sooner or later some of the known veins or others yet to be uncovered will become productive mines.

Easterly from Prince George the country again becomes mountainous and the northern representatives of the Columbia and Rocky systems are found; these are respectively the Cariboo and Rocky mountains. It is in the Columbia system that the important mineralized areas of East and West Kootenay are found, so that it may be expected that substantial ore-bodies may yet be found in the Cariboo mountains. To the south in the Cariboo Division this range of mountains has been prospected slightly, but only slightly, while to the north of the railway it is but little known.

It is known that at Tete Jaune there are some good mica deposits and that to the north and south for miles there are numerous deposits of mica.

In a general way the Rocky mountains consist mainly of sedimentary formations, sandstone, shale, and limestone, and, as such, are not particularly favourable for containing lode-mineral deposits. Where these formations are intruded by igneous rocks the possibilities for mineralization would be all right, but such intrusions are not known to be of common occurrence in the range.

To the north of the railway-line there is a vast area in the North-eastern District which has so far been but little prospected. The difficulties of transportation make it practically useless to prospect except for placer gold or very high-grade ore. It is interesting to note that there is known to be a very large deposit of galena in the vicinity of Fort Graham on the Finlay river.

This galena unfortunately carries little or no silver, and the deposit, as it is situated far from transportation, is therefore of no commercial value at the present time.

Similarly, there is a large area south of the railway and on the eastern contact zone of the Coast range which is at present handicapped by lack of suitable transportation. Valuable ore-bodies are known and located in this area and will be developed as soon as better transportation is provided.

For the present, therefore, prospectors are advised to search in those areas which are reasonably close to the railway-line or some other suitable transportation route.

Turning now to placer-prospecting, it may be safely said that the North-eastern District offers the prospector greater possibilities than any other part of the Province. Mining in British Columbia, with the exception of coal-mining, practically commenced with the working in the early sixties of the bonanza placer goldfields of the Cariboo. Since that time placer-mining has been continuously carried on in the Cariboo, but, as might be expected, the yearly production has declined greatly from the early years. During the war years the production fell away to a very low figure, but in the last two years an encouraging increase has commenced.

The easily available rich ground of the Cariboo has apparently in large part been worked out, but this is a generalization which may have many exceptions, as has been well proven by the discovery of bonanza ground in the Cedar Creek camp in the last two years. Further prospecting is continually being directed in the hope of finding continuations of the old rich "leads," or portions of the leads that were overlooked by the old-timers, and a certain percentage of successes always rewards these efforts. It must be remembered also that there are many places and creeks in the Cariboo in the zone of the gold belt that have never been prospected to any extent. These are the places where local conditions are such that the bed-rock gravels are deeply concealed by overlying gravels and clays that give no indication of values underneath. In other words, these are places where the gold is so effectually hidden by nature that more intensive prospecting methods are required than was the case in the old diggings. It can therefore be confidently asserted that the Cariboo still offers many possibilities for the placer prospector and the small mining syndicate.

In particular the Quesnel Lake section, in which is situated the Cedar Creek camp, is considered a promising field for the placer prospector. The experience to date shows that the important placer deposits in this section are "high-run" deposits, and that, in prospecting, the search should be directed to the high plateau-levels rather than in the deep valleys and canyons.

The greatest resource of placer gold in the Cariboo District, however, is in the large deposits of low-grade gravels, which must be worked on a large scale by hydraulicking or dredging methods. Mining of this kind calls for plenty of capital for adequately testing the ground and then to put in the necessary equipment and machinery. There are opportunities, however, for the prospector in taking up this class of ground and by hand-work doing the first testing, and later selling to companies with the requisite capital.

The Manson Creek section in the Omineca Division is another old placer camp. It embraces the area of country which is roughly bounded by Takla lake on the west, the Parsnip and Finlay rivers on the east, the Nation lakes to the south, and the Ingenika river to the north. This is a large expanse of country in which placer operations have been carried on at different points, but with large areas lying between them which have never been tested. Undoubtedly this is a vast virgin field remaining for the placer prospector, and it is supplemented by the country to the north of the Ingenika which is but slightly known. At the places in the Manson Creek section where placer-mining has been carried on there are known to be large deposits of low-grade gravels which are awaiting large-scale mining. The difficulties of transportation into this section have so far stopped this form of mining. Railway transportation is not, however, necessary for placer-mining and the construction of a road easterly from Takla lake would open up this country very considerably. If the developments planned for the season of 1924 materialize it is possible that such a road will be commenced, and this, combined with the water route from Fort St. James to Takla lake, will materially assist placer-mining in this section.

It is generally recognized that the plateau region or central part of British Columbia is the most promising part of the Province for placer-gold deposits to occur, inasmuch as in this area some of the rich gold-bearing Tertiary gravels have been left, whereas in the mountainous regions conditions have not been favourable for the deposition of such gravels, and where

deposited they have later been removed by the intense forces of erosion that have been active. The North-eastern District contains a large part of this plateau region of British Columbia and contains the camps that have been the most active producers of placer gold. As a considerable part of the plateau region in this district has not been intensively prospected for placer, it is therefore a favourable place for the real prospector to test his luck, and also his skill.

In the foregoing discussion on prospecting opportunities no attempt has been made to give exact details of where to prospect and many localities have not even been mentioned, but it is considered that enough has been said, however, to emphasize the fact that the district does present opportunities for the prospector, and, in conclusion, it is hoped that any one wanting information on where to prospect will communicate with the Resident Mining Engineer. Full details of suitable areas, transportation, trails, and types of mineralization likely to be found will be gladly given to any one interested.

OPPORTUNITIES FOR CAPITAL

The North-eastern District now presents favourable opportunities for the acquirement of mineral properties by mining capitalists. For lode-mineral properties the best known and most active part of the district is the Hazelton-Telkwa section. In this section thousands of claims have been staked in the past fifteen years. As is the case with all mining districts, the great majority of these claims are not likely to prove of value, but it is believed that a fair percentage of these claims are worth at least preliminary development and that a number of them will eventually make productive mines. That it has been hard to interest capital in the district is not difficult to prove. As an illustration, it may be said that of the dozen properties taken up by J. F. Duthie and the Federal Company during the last two years, every one of them had been staked for several years before being acquired and most of them had been described in the Annual Reports of this Department. It is apparent now that the district has attracted some attention, and that during the coming season of 1924 "scouting engineers" will pay considerable attention to it.

In the district there are many different types of ore-deposits. The important metals found in ores in different parts of the district are gold, silver, copper, lead, and zinc, while tungsten, molybdenite, and cobalt deposits are known. In some deposits the arsenic content, usually contained in the arsenopyrite, may prove to be a source of profit as a by-product. Most of the ore-deposits may be classed as from medium to high-grade ore, while in the Skeena section there are bodies of low-grade copper ore.

There are abundant opportunities for large-scale placer mining in the Cariboo and Quesnel Divisions and in the Manson Creek section of the Omineca Division.

There is an excellent opportunity for some one to carefully investigate the mica-deposits at Tete Jaune and in that vicinity. At the present time the demand for mica is firm and good prices for the various grades are obtainable. It is known that there is some good-quality muscovite mica near Tete Jaune, but development is needed to determine something as to quantity. Good transportation is provided by the Canadian National Railways. A description of one of the deposits was given in the 1920 Annual Report.

For the coal-miner there are a number of small coal-basins of good-quality bituminous coal awaiting development in the Telkwa section. Some of these have been partially developed, but require to be opened up and equipped. The local market throughout the district and at Prince Rupert is constantly growing, and at present most of this market is being supplied by coal from Alberta or Vancouver Island.

OMINECA DIVISION

SKEENA SECTION

Usk.

Kitsalas Mountain Copper Co.

Small-scale work was carried out by this company and work is being continued throughout the winter. This property has been described in several previous Annual Reports. It has two quartz veins which are irregularly mineralized with high-grade copper minerals, chalcocite, and tetrahedrite, and in addition carries variable gold values. The shoots of ore have so far been small and discontinuous, but development has been carried on with the hope that more extensive shoots would be found.

Kleanza Co.

Further mining-work was carried on by this company during the year. An option was obtained on the *Usk* group on Bornite mountain and some surface work was done on it. On the *Valhalla* group and the *Trona*, owned by the company, assessment-work was done. The showings on the *Usk* group consist of irregular mineralization in a series of acid volcanic rocks. No appreciable ore-body was noted anywhere, but small fractures occur in which bornite, chalcopyrite, galena, and pyrite are disseminated. The development-work consisted of surface cuts and stripping along the banks of Emma creek, where the rock formation is partially exposed. It is not known whether any commercial-sized bodies of ore were shown up by the work after the property was examined. Representative samples taken at that time across 2 to 5 feet of slightly mineralized material only returned traces of gold, silver, and copper.

Diadem Group.

This group of seven claims, owned by A. Baxendale, is situated up the railway-track 2½ miles from Usk, or near the sawmill point of Hanall. The property lies about half a mile north-west of the track and at elevation of from 800 to 1,250 feet above sea-level. It is an ideal location for easy development and low-cost mining. The formation is mostly a white siliceous rock that is probably an acid volcanic rock, somewhat of the composition of a rhyolite. In places it is considerably silicified with the development of quartz masses and stringers, and in other places is schistose. The whole formation at this point has been subjected to considerable fracturing and shearing, and in some of these fractures quartz and copper minerals have been deposited by replacement action. Fractures were noted striking north-westerly and others with a north-easterly trend. Irregular mineralization is evident over a considerable area, but more development would be needed to line up the different exposures.

Development consists of a number of open-cuts and shallow shafts. The important mineral is chalcopyrite and with this some pyrite occurs. As a rule the quartz is nearly barren, the copper and iron minerals being associated with a gangue which is altered country-rock. In a shaft 12 feet deep there is one band of rock well mineralized with yellow copper; a sample across this width returned on assay: Gold, trace; silver, 1 oz. to the ton; copper, 7 per cent. Alongside this band on the hanging-wall there is a band of quartz 2 feet wide, which, however, is not mineralized. On the foot-wall and generally throughout the rock-matter of the shaft there is more or less mineralization with chalcopyrite. A grab sample of the dump from the shaft returned: Gold, trace; silver, 0.6 oz. to the ton; copper, 5 per cent. At another showing a sample across 6 feet assayed: Gold, trace; silver, 4.6 oz. to the ton; copper, 2.8 per cent. A number of similar showings which are somewhat less mineralized occur on different parts of the property. The owner should concentrate his work in an endeavour to connect up the different showings to see if there is any continuity to the ore-shoots.

Silver Basin.

Silver basin is a typical glacial cirque forming the head of Chimdemash creek, which is a small stream entering the Skeena a short distance above the town of Usk. To get to Silver basin the trail up Kleanza creek is followed to about the 14-Mile post (15½ miles from Usk), and from there a blazed trail is followed up over the ridge separating Kleanza creek from Chimdemash creek to the basin. The mountains at the head of the basin are fairly rugged, and on one side lies Kleanza creek, which extends for a few miles farther to the east, and on the other a northerly-flowing fork of Legate creek. A better route would be obtained by following up Chimdemash creek. There is a trail for 7 miles from Usk up this creek, but another 7 miles of trail-construction is needed to reach the basin. Part of this was constructed this year.

The rock formations in this section consist mainly of a series of tilted, broken, and altered volcanic rocks, probably referable to the Hazelton formation. A great variety of volcanic rocks can be seen, such as rhyolite, felsite, red, green, and brecciated andesites, basic porphyritic rocks, and diabase. Some of the rocks may be sill-rocks, but many of them undoubtedly are flow-rocks. Intrusive into the volcanic series are numbers of dykes, generally of an acidic composition. The veins apparently always occur in a fine-grained rock that weathers to a rusty colour, but on a fresh surface varies from white to a light-greenish colour. In places this rock has the appearance of an intrusive dyke or sill and in others would seem to be a flow-rock.

The veins are small and generally consist of parallel stringers with intervening rock-matter. The gangue is partly quartz, but silicified partially altered wall-rock forms the greater part of

it. The important metallic mineral is grey copper, and associated with this there is a small amount of native silver in flakes and wires; it is quite evident that this native silver is of secondary origin from the breaking-up of the grey copper by surface oxidation and leaching waters. Other minerals occurring are galena, pyrite, chalcopyrite, and small amounts of bornite and chalcocite. Iron oxides and copper carbonates stain the outcrops, but are not of importance. The principal value in the ore is silver, which is carried in the grey copper and to a lesser extent in the galena.

The necessity of packing all supplies by "back-pack" from the Kleanza trail has prevented much work being done on any of the showings, so that only shallow cuts and strippings have been made. The pioneer in the camp is J. D. Wells, who has had claims for a few years. Other claims were staked this year by Stewart Bros. and partners. Some prospecting has been done in past years by prospectors coming up the fork of Legate creek and going over the northerly side of Silver basin. There are numerous small stringers of ore showing in different places, and what is needed is a certain amount of work on these different showings.

Silver Basin Group. This property, owned by J. D. Wells, is situated well down in the basin not far above timber-line. The main showing is at the foot of a small fall which may be considered as about the starting-point of Chimdemash creek. The vein is from 6 to 10 inches wide and exposed at intervals for about 200 feet or more. It is sparingly mineralized with grey copper, galena, and a few specks of native silver. A sample taken across 6 inches returned: Gold, 0.3 oz.; silver, 130 oz. to the ton; copper, 2.4 per cent. Another sample across 4 inches from a cut higher up the creek and near the top of the falls assayed: Gold, 0.12 oz.; silver, 67 oz. to the ton; copper, 0.9 per cent. The vein strikes N. 25° W. and dips at 80° to the east, and is in places slightly faulted.

Silver Horde Group. This group adjoins the *Silver Basin* group, extending up the basin to its head and up on to the mountain lying between the basin and Kleanza creek. There are four claims in the group and it is owned by J. D. Wells and A. Roark. One vein is exposed down in the basin which is from 6 to 20 inches wide and subsidiary parallel stringers. The usual minerals are found, but the only important one is the grey copper. Development consists of some open-cuts. A sample taken across 20 inches in one cut returned on assay: Gold, trace; silver, 14.3 oz.; copper, 2.7 per cent. Another sample across a 4-inch band in the vein, which was well mineralized with grey copper, gave: Gold, 0.04 oz.; silver, 142 oz.; copper, 5.6 per cent.

There are a number of showings on the claims on the mountain at the head of the basin, but as a rule these carry more yellow copper and less grey copper than the showings down in the basin. Two samples taken from these across 6- to 8-inch stringers gave: Gold, traces; silver, 6.7 and 6.5 oz.; copper, 3.4 and 1.8 per cent.

Grey Copper Group. This group of four claims is situated on the northerly side of the basin and extends over towards the fork of Legate creek. The owners are A. Stewart, F. A. Stewart, Jim Gall, Joe Bell, and Dan McLarty, all of Usk. The showing on this property consists of a number of quartz stringers mainly mineralized with grey copper. The stringers are up to 8 inches in width and in one place there are three or four of them in a total width of 6 feet. As the claims were only staked during the summer no development has been done on them. A sample of one of the 6-inch stringers assayed: Gold, 0.04 oz.; silver, 61 oz. to the ton; copper, 3.6 per cent.

On the Legate Creek divide there is a conspicuous outcrop of quartz float which is evidently not far from the vein that it came from. The quartz is mineralized with grey copper and galena and the size of the pieces of ore show that the vein is from 1 to 2 feet wide. A representative sample of this ore assayed: Gold, 0.02 oz.; silver, 49 oz. to the ton; copper, 1.4 per cent. This vein should be worth prospecting for.

Lucky Jim Group. This property is situated close to the 12-Mile post on the Kleanza Creek trail (13½ miles from Usk) and is owned by Fred Forrest, of Usk. A description of the property was given in the 1920 Annual Report. The principal showing is on the *Idaho* claim and development of this showing had just been commenced by the owner in 1920. Since then the owner has done good work in opening up the showing with a large open-cut, which approaches the dimensions of a railway cut. The face of this cut, which is about 25 feet high, shows a well-defined fracture striking N. 35° W. and dipping to the south-west at 60°. Proceeding outward from this fracture the country-rock on both walls

is mineralized with copper minerals; on the foot-wall side of the fracture this mineralization is slight, but on the hanging-wall side it is well developed, so that varying widths from 5 to 10 feet may be classed as ore. The wall-rock is of an andesitic nature and is in most places somewhat porphyritic. It shows in places a poorly defined jointing, the strike of which makes an acute angle with the central fracture.

Mineralization is principally with bornite, and a very little yellow copper. Copper carbonates are disseminated through the rock-matter, but it is evident that this is a surface oxidation feature, and it is unlikely that these carbonates will continue to any great depth.

The following tabulation shows the assays of samples taken in 1920 and in 1923:—

Description.	Gold.	Silver.	Copper.
	Oz.	Oz.	Per Cent.
Across 5½ feet, face of upper cut (1920)	Trace	Trace	3.5
Grab sample of whole dump (1920)	Trace	3.2	8.0
Across 5 feet, face of big cut (1923)	0.04	2.7	5.4
Across 5 feet, face of upper cut (1923)	Trace	4.6	6.9
Across 7 feet in big cut 4 feet above bottom (1923)	Trace	2.7	6.3
Grab sample of whole dump from big cut	Trace	0.4	5.5

It is evident that this property has merit as the possibility is for a fair tonnage of medium-grade copper ore. Surface secondary action may possibly cause richer values than will be obtained at depth, but this is by no means certain. Mineralization is showing in an irregular way for distances up to 20 feet away from the central fracture, so that wider, though lower grade, ore-bodies may be obtained than showing in the cuts.

Late in the fall the property was bonded by the Federal Mining and Smelting Company. It was not considered practicable to commence operations with winter weather coming on, but an early start will be made in the spring. The property is excellently situated, at an elevation of about 3,000 feet, well supplied with timber, and a fairly good water-power available, not far away, in Kleanza creek. The ore-body can be easily tested by means of a drift-tunnel and future mining operations could be carried on for a long time by means of tunnels. The distance of the property from the railway is not excessive for the hauling of concentrates if sufficient ore is found to warrant the erection of a mill.

The development of this property will be interesting, as it will serve as an indication of what may be expected from a number of properties at the head of Kleanza creek. On these claims (which have been all described in previous Annual Reports) there are numerous showings of irregular sheared and shattered zones carrying bornite, chalcocite, and chalcopyrite. The possibilities for these claims are that substantial tonnages of low-grade copper ore might be proven by development, and, as the *Idaho* showing is somewhat similar, its development, if successful, would stimulate further interest in these properties.

Lucky Luke.

This property, which is owned by L. E. Moody and Richard Lowrie, has been described in previous Annual Reports. It adjoins the *Cordillera* property of the Kitsalas Mountain Copper Company and is well situated, being only a short distance above the railway-line and about 1½ miles from Usk. The vein occurs in schistose rock and is well defined, being from 1 to 2 feet wide. The gangue is quartz and altered schist carrying bornite, chalcopyrite, and a little pyrite; chalcocite is sometimes found. Associated with the copper minerals and in places with the white quartz is a certain amount of gold content which is apparently quite variable. Very good assays are sometimes obtained from quartz showing very little copper sulphides.

An option on the property was taken late in the fall by S. A. D. Davis and partner. Small-scale work was started and is being carried on during the winter. The previous development-work had consisted of a drift-tunnel on the vein 60 feet in length, with a winze 18 feet deep, at a point 30 feet from the portal. Mr. Davis commenced work in the winze and later intends to run a short crosscut tunnel which will give some depth below the bottom of the winze. In the spring the surface water would prove very troublesome to handle in the winze and a power-pump would be required. Mr. Davis expects to get out two or three cars of ore during the winter. By hand-sorting a product running from $50 to $100 a ton should be obtained.

Henderson Mine—Tractor transporting Boiler.

Francois Lake—Settlement South Shore

Copper King Group.

This property is owned by Peter Brusk. It is situated on a creek lying between Vanarsdol and Usk and is distant 4 or 5 miles from the latter place. Mr. Brusk has a ranch not far from Vanarsdol and the property is about 2 miles from the ranch. Up the creek from the ranch the country is rugged and steep and covered with a heavy growth of timber. The formation mainly consists of a black fine-grained rock of the nature of diabase and this is cut by narrow granitic dykes. On the property there are several well-defined quartz veins varying from 1 to 4 feet in width. They are mineralized with pyrite and a little chalcopyrite. The copper content is unimportant, but in places gold values are also obtained.

The parts of the veins where sampled failed to show much gold content, but it is possible that somewhere these veins may carry shoots of ore that would pay to work. Following are the assays obtained:—

Description.	Gold	Silver	Copper.
	Oz.	Oz.	Per Cent.
Across 3 feet, No. 1 vein	0·24	0·4	*Nil*
Across 3 feet, No. 2 vein	0·06	0·8	*Nil.*
Across 3 feet, No. 2 vein	0·06	0·6	*Nil*
Across 18 inches, No. 3 vein	Trace	0·6	*Nil*

The development-work consists of numerous open-cuts and some tunnelling. The above assays do not look very favourable, but the appearance of the veins is such that a certain amount of work to explore them along the strike seems justified. The property is excellently situated for cheap mining and comparatively low-grade ore might be handled at a profit.

Legate Creek.

It was intended by the Resident Mining Engineer to make an examination of this section this year, but unfortunately time did not permit. The properties have been described in previous Annual Reports, but further work has been done on some of them since they were last examined.

Development of the *Independence* group was carried on during the summer by Sweeney & Burns with, it is claimed, satisfactory results. Some work was also done on the *M. & K.* and *Frisco* groups, and annual assessment-work was done by claim-owners.

Dorreen.

Fiddler Group.

This group, situated on Fiddler creek, 1½ miles from Dorreen, was acquired under option in November by J. F. Duthie. This property was described in detail in the 1916 Annual Report and references to it will be found in other reports. The property was developed prior to 1917, but since that time very little has been done on it. It is owned by an Edmonton syndicate. The property has a very well-defined and persistent quartz vein which has been traced on the surface for about 1,000 feet. It is throughout well mineralized with iron, copper, zinc, and lead sulphides, the most important value being in gold, but with the silver and copper content also appreciable. Development consists of surface cuts and a tunnel. A crosscut tunnel was started in 1916, but this after going through 100 feet of surface material, was stopped shortly after bed-rock was reached.

As soon as Mr. Duthie obtained the property a crew of about fifteen men was started at work under the superintendency of John R. Turner, who had previously been in charge of the operations of the Duthie mines for Mr. Duthie. By the end of the year the camps had been repaired and reconstructed and the road to Dorreen, 4½ miles, cleaned out and repaired, this work being considerably hampered by bad weather. The work of driving the crosscut tunnel is being continued during the winter.

HAZELTON SECTION.

Silver Standard.

This mine was closed down all year. The property is now in the position that further development will be required before it can again become productive. From the 250-foot level to the surface on the two main veins most of the known ore is worked out. There is substantial evidence that the ore-shoots continue downwards, as shown by the shaft on the main vein, which is down 450 feet. Slightly better

freight and treatment rates are now obtainable on the silver-lead concentrates than when the property was last worked early in 1922. The property is essentially a silver-mine, although some return was obtained from the lead and zinc content.

The property has a good record of past production, the total tonnage of ore mined and milled having been about 14,500 tons, which contained approximately 1,100 oz. gold, 626,000 oz. silver, 1,225,000 lb. lead, and 1,400,000 lb. zinc. The gross value of this production would be somewhere about $500,000. Prior to 1918 the ore shipments consisted of hand-sorted ore, but after that practically all the ore was milled and lead and zinc concentrates were shipped. These concentrates were high grade, the lead product running from 200 to 225 oz. silver to the ton and the zinc concentrates from 80 to 120 oz. to the ton. The property is nicely situated, being only 5 miles from the railway and supplied with good motor-roads to the mine and mill, which latter is 2 miles distant from the mine. It is to be hoped that the owning company will recommence operations in 1924 or turn the property over to some one who will.

Rocher Deboule Mountain.

None of the properties on Rocher Déboulé mountain were operated during the year, but assessment-work and small-scale development were carried out by prospectors. A promising strike of tungsten ore on the *Red Rose* group was reported, but the showing has not yet been examined by the writer. The property is now under option to W. S. Sargent, and a sample taken by him across 6 feet of the vein returned on assay 21 per cent. tungstic oxide. A new vein was discovered on the *Cap* group by the owner, Denis Comeau, from which a good assay in silver and copper was obtained.

The property of the Delta Copper Company, which was partially developed some years ago, is considered a promising one and merits further operation. The company is believed to be short of capital and the condition of the copper market has made it difficult to interest capital in copper-mining enterprises. All the properties on the mountain have been previously described.

Nine-mile Mountain.

There are a number of claims on Nine-mile mountain which have been staked for a number of years. Most of them have been described in previous Annual Reports and also in Memoir No. 110 of the Geological Survey, Canada, by J. J. O'Neill.

There are on the different claims a large number of veins which range in width from a few inches up to about 10 feet and are traceable for variable distances on the surface. They are mineralized with galena, zinc-blende, stibnite, jamesonite, and a little grey copper. The main value in the ore is silver, which occurs in the galena and also in the antimony minerals. Where found, the grey copper is rich in silver. It is now quite evident that no appreciable tonnage of ore could be procured from these veins by hand-sorting that would be sufficiently high grade to stand shipment over a pack-trail and show a profit over all expenses. It is, however, quite possible that development would show that some of these veins, either individually or collectively, carry large enough shoots of good-grade milling-ore to pay to work. Much more development, however, is needed than any of the properties have yet had done before the erection of a concentrator would be justified.

Sunrise.

The best-known property on the mountain is probably the *Sunrise*. It is owned by the Sunrise Mining Company, but is now under option to the Trethewey Bros., who kept three to four men developing most of the year. Two drift-tunnels were run on one vein and another tunnel cutting a number of flat-lying ore bands was driven in farther. The results of the work were sufficiently satisfactory to warrant more extensive development. It has been therefore decided to drive a crosscut tunnel which will cut a number of veins and should definitely prove the value of the property; as projected, this tunnel will be about 1,000 feet in length. A gasolene-driven compressor and outfit will be taken in to the property during the winter, and the tunnel-work will be started in the spring as soon as is practicable.

Empire Group.

This group, which is a relocation of the old *Lead King* group, was re-examined during the year, and this description gives a fair idea of the type of ore-deposits found on this part of Nine-mile mountain. The property adjoins the *Sunrise* and is owned by Tommy Railson, of Hazelton. There are a number of veins and stringers on this property, some of which were partially developed by open-cuts, tunnels, and a shaft by the old *Lead King* company prior to 1912. These veins occur in granodiorite and are of the sheared-zone type, in which altered and silicified wall-rock forms the greater part of

the gangue, with subsidiary amounts of quartz. The principal metallic minerals present are galena, zinc-blende, and jamesonite in about equal amounts.

One of the veins has been opened up in a new place by the present owner; the work done consists of stripping of the vein for about 50 feet. This shows the vein to be from 12 to 30 inches wide and some subsidiary stringers in the walls. In the best-exposed place the vein is about 30 inches wide and is sparingly mineralized with mixed sulphides across this width. A sample taken across the full width assayed: Gold, trace; silver, 31 oz. to the ton; lead, 1 per cent.; zinc, 8 per cent. One band in the centre of the vein about 6 inches wide consists of nearly solid galena, zinc-blende, and jamesonite, but a sample of it only assayed 19 oz. silver, together with 16 per cent. lead and 10 per cent. zinc. A sample of the best ore taken out of the vein and piled to one side assayed: Gold, trace; silver, 15 oz. to the ton; lead, 14 per cent.; zinc, 21 per cent. The higher silver assay obtained from the average sample across the full width of the vein, with much lower lead and zinc content, probably shows that there was some grey copper in the sample.

The vein which was developed by the *Lead King* company lies down the hill from the one previously described. The shaft on it is said to be 50 feet deep, but could not be examined owing to water. A sample of the vein taken across 20 inches (full width) near the mouth of the shaft returned: Gold, trace; silver, 33 oz. to the ton; lead, 10 per cent.; zinc, 15 per cent.

There are two or three veins lying between the shaft-vein and the ore being developed by the present owner. At different places these show widths varying from a few inches up to 3 feet and irregular mineralization. In many places cross stringers and fractures cut the veins. A sample taken at one place across 18 inches assayed: Gold, trace; silver, 8.2 oz. to the ton; lead, 6 per cent.; zinc, 15 per cent.

The possibility for the property is that one or more of the veins may on development be shown to contain enough ore to warrant the erection of a small concentrator. If the development on the *Sunrise* is successful, improvements to the transportation would be made which would assist all the claims on this side of Nine-mile mountain, and the success of one property would induce capital to develop other adjoining claims.

American Boy. This property is situated on the west side of Nine-mile mountain. It was worked some years ago and some ore shipped, but has been idle during recent years. It has three or more quartz veins which are similar in character to those of the *Silver Standard* and contain high-grade silver minerals. (For a description see previous Annual Reports.) If further developed and equipped with a small mill this property could probably be operated at a profit.

During the summer some work was done on the *Lakeview* claim, which adjoins the *American Boy*. The vein, which is believed to be a continuation of one of the *American Boy* veins, was prospected for some distance along the strike. It is mineralized with galena and zinc-blende and some of the cuts look promising for the development of shoots of this ore.

Sultana Group. This property, which is situated on Boulder creek, was fully described in the Annual Report for 1922. Early in 1923 an option on the property was taken by the Granby Consolidated Mining, Smelting, and Power Company and in July development was commenced. The 10-mile pack trail from the main road was improved and a gasolene-driven diamond drill was taken in to the property. The open cuts on the property were cleaned out and deepened slightly and one diamond-drill hole was put down for a distance of about 80 feet. The hole was located so that in going down on an incline it was believed that it should cut the ore-body showing in the big cut. No further drilling was done and all work was stopped and the option relinquished; the inference is that the results obtained by the work were not encouraging. The property has not been examined by the writer since the work was done and no information has been received from the company, but it is reported that the diamond-drill hole only showed about 8 inches of ore. As the showing in the cut above consists of a width of 10 to 15 feet of good-grade silver-copper ore, much more was to be expected in the diamond-drill hole.

It is estimated that there is 400 to 500 tons of ore in sight in the surface exposures and it is the intention of the owners to mine this in 1924. By hand sorting it is believed that several cars of ore high enough in grade to pay to ship can be obtained. In the work of extracting this known ore it is also possible that a downward continuation of the ore-body may be found, as the testing done by the Granby Company can be fairly described as limited.

TELKWA SECTION.

The name "Telkwa section" is used to embrace a large area of country from Moricetown to Telkwa, and includes Hudson Bay mountain, the Telkwa river, Dome mountain, Driftwood creek, and other camps in the Babine range. All these different mineral camps are tributary to the towns of Smithers and Telkwa, both of which are situated on the railway-line in the Bulkley valley. Smithers is a divisional point on the railway and is the starting-point for Hudson Bay mountain and the properties on Driftwood creek. Telkwa is situated 10 miles up the railway from Smithers and is the centre for Dome mountain and properties up the Telkwa river. Coal properties on the Telkwa river use the town of Telkwa as the shipping-point.

HUDSON BAY MOUNTAIN.

Duthie Mines.

The property of the Duthie Mines, Limited, consists of the *Henderson* and *Mamie* groups, situated on the southern slope of Hudson Bay mountain, and distant about 14 miles from Smithers. These properties were acquired under option by J. F. Duthie, of Seattle, the *Mamie* being taken up first and then the *Henderson* in the summer of 1922. The purchase price of the *Henderson* has been paid in full and progress payments have been made on the *Mamie*. In July of this year a 55-per-cent. interest in the whole property was sold by Mr. Duthie to a syndicate formed by the Guggenheim organization. Under the deal a company known as the Duthie Mines, Limited, has been organized and the various syndicate interests apportioned in shares. The operating management of this company is controlled by the Federal Mining and Smelting Company, a Guggenheim subsidiary company. Up to the change of control John R. Turner was superintendent in full charge of operations, but under the Federal control Charles E. Wethered was made superintendent. Mr. Turner's time since July has been fully occupied in looking after Mr. Duthie's other mining interests in the district.

The properties were fully described in last year's report, together with a sketch-map showing the claims and workings, so that only the development during 1923 need be outlined. During the first half of the year all work was concentrated on the *Henderson*. Most of this was on the Water tunnel level, now known as the "Compressor" level, and consisted of drifting on the vein, raising, and the laying-out of stopes. It was apparent that more power was needed as the two small gasolene-driven compressors were inadequate for the work planned. Early in the spring, therefore, machinery for a steam-driven compressor plant was ordered, and also a 10-ton tractor was bought which greatly assisted in getting the machinery to the mine. The road had been badly cut up by the heavy hauling over it and without the tractor it would have been a difficult matter to get the two heavy boilers in. About this time construction of the new road was commenced, but it was not completed until late in the fall.

The site chosen for the new steam plant was at the Compressor level. It consists of two 100-horse-power stationery boilers set in bricked-in emplacements and two steam-driven compressors on concrete foundations. One of these compressors delivers 1,000 cubic feet of air a minute and the other 500 cubic feet, at 100-lb. pressure. The boiler and compressor plant are contained in one building and close to it is the blacksmith-shop, which latter is equipped with an oil-fuel furnace for heating steel and the usual pneumatic-drill sharpeners for machine-drills. The power-plant was designed to take care of both the *Henderson* and *Mamie* properties, compressed air being piped over to the latter.

The Compressor level was started as a crosscut and the vein was cut at a distance of 300 feet from the portal. Later on the vein was drifted on from this point out to the surface, so that there are now two points of entrance to the Compressor level. At the second entrance are situated the main ore-sorting tables and ore-bins for the property. These were laid out in the early summer, so that the new road to the property would come below the ore-bins from which shipments of hand-sorted ore are made.

During May and June very little work was done in the mine, but a large crew was kept on the construction-work, including the power-plant, road-construction, and much incidental work. During this time, however, stopes were started from the Compressor level. Two miles of new road was constructed by the company to connect the Compressor level workings on a suitable grade with the main road below. At the same time work was started by the Government to build 7 miles of new road from Smithers to a point on the old road. This 7 miles of new

road was built as an alternative to repairing the lower 5 miles of the old road. This portion of the old road after leaving the railway-yards at Smithers goes up a narrow canyon, in which it was found impossible to maintain a road subject to heavy haulage. Owing to the seepage of water from the sides in both summer and winter much trouble was experienced with this road and it had grades up to 20 per cent. which could not be removed. The new road is laid out on suitable grades and provides a main trunk road which, when extended from time to time, will serve all the mineral properties on the south side of Hudson Bay mountain. This is also the route into the Copper River coalfields.

With the change of ownership and control of this mine in July, there was no marked change in the operations. Development and extraction of ore from the *Henderson* property were proceeded with. The completion of the power plant late in July gave plenty of power for all purposes. At the end of the year the new management had done 1,100 feet of drifting and crosscutting. This work was divided between the McPherson tunnel, Intermediate and Compressor levels. The McPherson tunnel has been extended 320 feet. It is reported by the management that the ore-shoots on the Compressor level, which looked promising in July, have become somewhat disappointing. The ore-shoot in the McPherson tunnel is about 200 feet long.

No work had been done on the *Mamie* from November, 1922, until the completion of the steam plant made it possible to resume operations in August of 1923. This property had been developed by a drift-tunnel and winzes and then a low-level crosscut tunnel was commenced and driven about 200 feet. This working was projected to be about 950 feet long before cutting the vein. After considering the matter the new management decided to run a lower drift level on the vein before carrying ahead the crosscut tunnel. This drift was started at a point 150 feet below the upper drift-tunnel and in line with the strike of the vein. By the end of the year this level was not in far enough to give any additional information about the *Mamie* vein.

During the period of operation of the property by J. F. Duthie approximately 320 tons of hand-sorted ore was shipped from the *Henderson*. From July to the end of the year the production was, roughly, 620 tons. Part of this amount was hauled to Smithers during the year, but none of it was shipped away until early in 1924. The first ore was shipped to the Trail smelter, but now the ore is held until several cars are ready for shipment, and then it goes to the Selby smelter at San Francisco. During the year improvements were made to the camp accommodation on the property and a telephone-line was constructed. The company maintains an office in Smithers and from forty to eighty men are employed.

Victory Group. The owner of the *Victory* group, Donald Simpson, worked steadily nearly all year on his property. Most of his work was on the upper part of the main vein in tunnels Nos. 2, 3, and 4. Satisfactory results were obtained and the year's work has enhanced the value of the property. Descriptions of the property can be found in previous Annual Reports, but it may be said briefly that the main vein on the property has been proven on the surface for a distance of somewhere about 1,000 feet and that it is mineralized in shoots with galena, zinc-blende, and pyrite. The vein is a fracture-zone in which there are bands and stringers of mineralized material. In the tunnels there are places which show from 2 to 4 feet of nearly solid mineral and still greater widths in places may be considered as milling-ore. Assays show that the ore carries about equal amounts of lead and zinc, but as a rule these minerals are so interbanded that it is practically impossible to separate them by hand-sorting. Silver values run from 1 to 2 oz. to the unit of lead. It is not considered that there is much silver associated with the zinc. As an indication of the values in the ore the following assays are given: —

Description	Gold	Silver	Lead	Zinc
	Oz.	Oz.	Per Cent.	Per Cent.
Sample across 2½ feet on hanging wall, main vein, No. 2 tunnel	0.10	31.0	25.0	23.0
Sample across 4 feet on foot wall, No. 2 tunnel, main vein	0.20	6.0	5.5	18.0
Sample of hand-sorted ore	0.10	56.0	38.0	15.0

The property is nicely situated for mining, being about 15 miles by good road from Smithers (via new Hudson Bay Mountain road) and the workings are below timber-line. It is equipped

with good camp buildings and a lot of preliminary work has been done. The property can be tested for a relatively small amount of money by means of a drift-tunnel, which would gain from 50 to 75 feet of depth for each 100 feet driven ahead.

Northern Slope of Hudson Bay Mountain.

On the northern and eastern slopes of Hudson Bay Mountain there are numerous claims, some of which have been described in previous Annual Reports. During the summer the *Silver Peak* group, which has never been examined by the writer, was taken up under option by D. J. Williams. In order to make a thorough examination of the showings some work was done in cleaning out old prospect-shafts and surface cuts. Several weeks were spent on the property by Mr. Williams in doing this work and sampling, after which he relinquished his option. There are said to be a number of veins on the property which carry galena, zinc-blende, pyrite, and arsenopyrite. The principal value is in silver, but some gold values are found with the arsenopyrite. The property is handled for the owners by A. C. Garde, of Prince Rupert.

Evelyn Group. This group of four claims is owned by Angus McLean and J. A. MacDonald, of Smithers. It is situated on the north-eastern slope of one of the northerly peaks of Hudson Bay mountain and about 4 miles from Evelyn Station. The showings are at an elevation of about 5,000 feet on a steep slope overlooking the Bulkley Valley. Quite a variety of rock formations are in evidence on this side of the mountain. On the lower slopes quartzites were noticed, while higher up there is a profusion of volcanic and sill rocks. At the top of the mountain granitic rocks outcrop, but whether as dykes or small bosses was not determined.

The main showing is on the *Fort George*, where there is a wide fractured zone, which, however, is but very slightly mineralized. It is developed by a large open-cut and some smaller ones. The metallic minerals present are pyrite, arsenopyrite, galena, and zinc-blende, occurring in a gangue of altered wall-rock which in many places is highly decomposed and oxidized. The wall-rock was not identified; it is probably of volcanic origin, but considerably altered. A section in the large open-cut shows between walls: 1 foot of oxidized material with some mineralization; then 4 feet of oxidized unmineralized material; then 3 feet sparingly mineralized; and then 6 feet of light-coloured rock and a few specks of mineral. A sample across the 1 foot assayed: Gold, 0.02 oz.; silver, 36 oz. to the ton; lead, 2 per cent. Another sample across the 3 feet returned: Gold, trace; silver, 5.5 oz. to the ton; and a third sample across the 6 feet assayed: Gold, trace; silver, 1.5 oz. A selected sample of the ore assayed: Gold, 0.04 oz.; silver, 174 oz. to the ton; lead, 26 per cent.

These assays show a high ratio of silver to lead in the ore and are encouraging. It is apparent that there is no appreciable quantity of ore showing in the zone where it has been opened up, but the size of it, together with the high grade of the actual mineral in it, should encourage the owners to do further development. Somewhere the zone may carry a good shoot of galena and it is believed that the possibility warrants further prospecting.

Cascade Group. This group of six claims is owned by A. S. Miller and M. E. LeBlanc. It is situated on the easterly slope of Hudson Bay mountain, about 3½ miles by trail from Lake Kathlyn Station. The elevation of the cabin is 3,600 feet and the showings are on the sides of a small creek just below the cabin. The main showing on which work was done this summer is a large sheared zone or possibly a line of faulting. It is 18 to 20 feet wide and is mostly made up of more or less crushed rock, in places quite graphitic. Small bands of quartz occur throughout and also "nigger-heads" of quartz. This quartz is sparingly mineralized with pyrite and arsenopyrite and a little zinc-blende. A crosscut tunnel was driven 180 feet to where the zone was cut and then across it; then a drift was driven along one wall for 25 feet. The work so far done may be classed as prospecting of the zone to see if shoots of ore occur in it. At the time the property was visited there was but little of the zone sufficiently mineralized to be classed as ore. Samples of the mineralized quartz on assay did not show gold or silver values of any consequence.

Farther up the creek there is a small vein, up to 18 inches wide, which is mineralized with galena, pyrite, and zinc-blende. From the strike of this vein it is believed by the owners that it will intersect with the large zone and that in the neighbourhood of the intersection a good ore-shoot may occur. A sample across 18 inches of this vein assayed: Gold, 0.26 oz.; silver, 1.5 oz. to the ton; lead, 25 per cent.

The rock formations exposed on these claims are the usual volcanic rocks that occur over a large part of the mountain—namely, andesite, rhyolite, and diabase.

Driftwood Creek.

Practically all of the mineral properties in the Driftwood Creek territory have been described in previous Annual Reports and a sketch-map showing their location was included in the 1921 Annual Report. During the year work was carried out on the following properties: Babine-Bonanza Mining and Milling Company's claims and the *Hyland Basin*, *Little Joe*, *Shamrock*, *Silver King*, *Iroquois*, and *Driftwood* groups. Only the *Hyland Basin* group and the property of the Babine-Bonanza Company were visited during the year.

Babine-Bonanza M. and M. Co.

Under the supervision of James Cronin, who is the principal owner of the company, a crew of ten to twelve men was working during the summer season on this property. The most of this work was done in the lower (or No. 2) tunnel in drifting on the ore-body previously cut in the tunnel. A little work was done in the "A" tunnel, where there is a big showing of ore. This was opened out in a small glory-hole and enough done to show that there are considerable possibilities at this point. The work in the No. 2 tunnel has not yet definitely proven that the ore-body exposed there is the downward continuation of the contact ore-body exposed in "A" tunnel and on the No. 1 level. Further exploration will be carried on in 1924 and it is possible that a concentrator will be erected, as Mr. Cronin now considers the mine nearly sufficiently developed for one.

Hyland Basin Group.

This property was described in detail last year. It is owned by Martin Cane and Tommy King, but was bonded, under option of purchase, in August by J. F. Duthie. A small crew of men was started at work shortly after and much open-cutting and stripping of the vein was carried out. As a result of this work it was decided to drive a tunnel 300 feet to prospect the showings at depth. A contract was let for this tunnel to two men and it is expected that it will be completed early in the spring of 1924. The main ore-showing on the property is a contact ore-body lying between rhyolite and schist and carrying galena, zinc-blende, pyrite, and grey copper, in a gangue of altered rhyolite and quartz. High gold and silver values are obtained from the selected ore. The surface work done on the property revealed some nice bands of nearly solid mineral and further development seems justified.

The strike of the "vein," or, rather, the line of contact between the schist and rhyolite, is somewhat irregular and is also slightly faulted. The tunnel is being driven more or less along the strike of this contact, but it was started in schist and no attempt will be made to explore the contact until the tunnel is driven in under the surface showings. As the ore-body is of somewhat the same nature as the contact ore-body in Cronin's mine, it is to be expected that a considerable amount of crosscutting and drifting along the contact will be required to outline the ore-shoots. The work is under the supervision of John R. Turner.

Driftwood.

This property is owned by a Smithers syndicate, of which J. J. Driscoll and H. Wright are members. During the year from two to four men worked intermittently on the property prospecting a number of small veins. These are sparingly mineralized with chalcopyrite, pyrite, and grey copper. The grey copper carries good silver values, but no large shoots of this mineral have yet been found. The syndicate has shown great persistence and it is to be hoped that their efforts will be yet rewarded.

Silver King Group.—During the year this property was examined by an engineer for the Federal Mining Company and an offer was made for the property, but no deal has so far materialized.

Little Joe.—Further development of this property was carried out by the owners, Cane & King. The main tunnel was driven ahead some distance and they report that the vein is well defined at the face and carries a nice band of the rich grey-copper ore.

Dome Mountain Camp.

Dome mountain, from which the camp is named, is situated in the Babine range about 23 miles in a direct line from Telkwa; by road and trail the distance is 3 or 4 miles longer. Claims were first staked on the mountain about ten years ago and many more have been located during the past two years. The operations of the Federal Company in this camp have created renewed interest and considerable prospecting was carried on during 1923 in the surrounding

territory. This portion of the Babine range, but north and south from Dome mountain, can stand a lot more intensive prospecting.

Dome Mountain Gold Mining Co.

The important known claims on the mountain were secured by option of purchase by T. E. Jefferson in the winter of 1921–22. In this deal Mr. Jefferson was backed by New York interests. During the summer of 1922 the various veins on the property were opened up and explored on the surface by cuts, shallow shafts, and stripping. The results were highly satisfactory, and as a result a deal was made at the beginning of 1923 whereby control of the property was sold to another New York syndicate financed by Guggenheim capital. By arrangement the managing control of the property was placed in the hands of the Federal Mining and Smelting Company (a Guggenheim subsidiary), and later a company known as the Dome Mountain Gold Mining Company was formed and the various syndicate interests apportioned *pro rata* in shares. Frederick Burbidge, general manager of the Federal Company, is general manager and treasurer of the Dome Mountain Company, and Henry Lee is superintendent in charge of the operations at Dome mountain. All the claims on the mountain that were under option to the Jefferson Syndicate were acquired by the new company and the original owners have been paid in full. In all, over twenty claims are held by the company.

A full description of the property and work done under the supervision of T. E. Jefferson in 1922 can be found in the Annual Report for that year. Work on the property had been stopped by the Jefferson Syndicate in October of 1922, as no preparations had been made for carrying on during winter weather.

Early in February of 1923 Mr. Lee arrived in Telkwa and immediately set about preparing for an active development campaign. In the first place, the 18-mile trail had to be broken and made into a sleigh-trail, over which supplies could be hauled in Yukon sleighs, and camps had to be erected. Winter conditions, with much snow and cold weather, made the work difficult to begin with, but before long the work was going ahead satisfactorily. It was apparent that in order to develop the "Forks" showing, shaft-sinking would be necessary and that the flow of water from the two creeks would make it advisable to have some substantial pumping machinery. It was therefore decided to take in a steam-boiler plant that would give sufficient power to do the pumping and hoisting and also run a small compressor, so that machine-drills could be used for the sinking of the shaft. In the meantime, until this power plant could be brought in, a start was made on the shaft by hand-work.

In order to take in the steam plant a road was required; a very rough road was therefore cut out following approximately the route of the trail. It was slow work getting the machinery over this road and for the greater part of the distance the boilers had to be hauled by block and tackle. The plant, which was finally erected and ready for operation in August, consists of two boilers, air-compressor, and a sinking-pump. It was erected close to the "Forks" showing.

As the outcrop of the "Forks" vein was in the bed of the creek, it was necessary to commence the shaft at some distance away on the bank of the creek, and apparently in the foot-wall. The shaft, which is of three compartments, two for hoisting and one for pipes and ladders, was sunk to a depth of 107 feet. On the 100-foot level a crosscut was driven to cut the vein. Drifting on the vein was progressing at the end of the year, but no exact information is available as to size and values. Much surface work has also been done on the "Forks" showing.

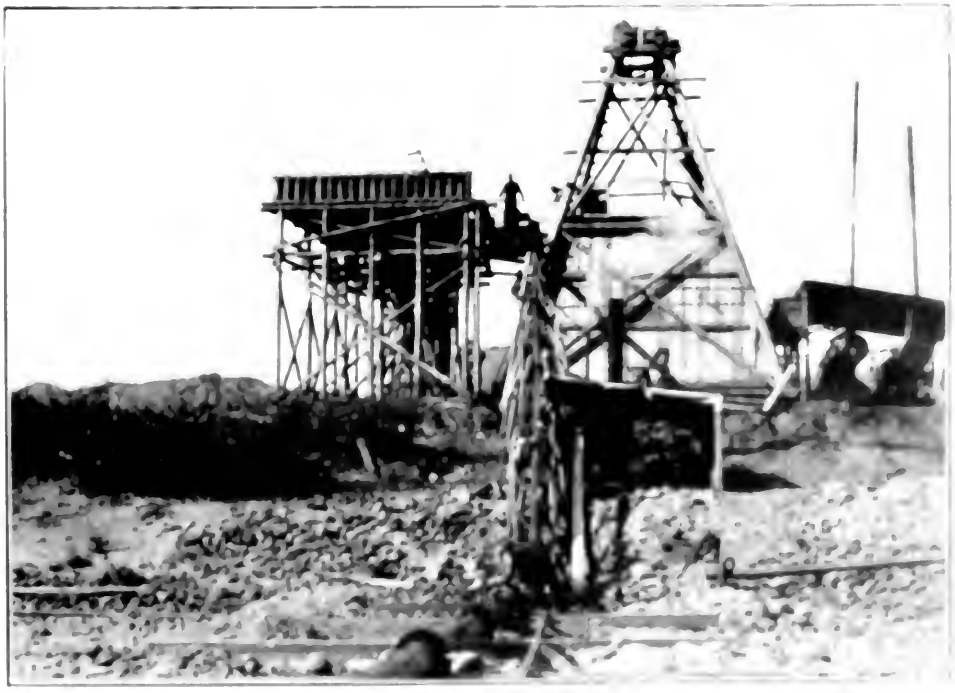
On the *Cabin* vein a prospect-shaft was sunk 30 feet at a point 200 feet east of the creek. Good width and satisfactory values were obtained. The old camp was enlarged and a crosscut tunnel was commenced to open up the *Cabin* vein at greater depth. It is estimated that this tunnel will cut the vein at a distance of about 300 feet, but by the end of the year it was only in about 200 feet.

A drift-tunnel is being driven on the *Snowdrop* claim to prospect what is known as the *Jane* vein, which in this working averages about 2 feet in width and is fairly well mineralized. The outcrop of this vein can be seen at intervals along the mountain for several thousand feet, but only at certain places does it show commercial values.

Some work has been done on the *Ptarmigan* vein; a cabin was built for camp accommodation and a tunnel is being driven to explore the vein at depth.

During the summer much surface work was done on various showings all over the mountain; the known veins were partially explored and some new ones were discovered. Development is

Peace River Gold Dredging Co.—Transporting Supplies



Peace River Gold Dredging Co.—Plant at Brenham Ltd.

being actively pushed during the winter with a force of about fifty men. The main camp buildings, which are situated a short distance from the "Forks" showings and shaft, now include bunk-houses, cook-house, office and hospital building.

In the fall of the year a survey was made for a new road into the property. By this survey about 15 miles of new construction will be required and connection will be made with a trunk road in the Bulkley valley. The total distance to Telkwa will be approximately 25 miles. No construction was done on this road, but if the results of development are satisfactory it will be built in 1924.

Chance Group. This group of claims, which adjoins the property of the Dome Mountain Gold Mining Company, is owned by Alex. Chisholm and partners. In July the group was bonded by the Trites-Wood Syndicate and a small crew of men was put to work under the supervision of Harry Howson. Work was discontinued in the fall. At the time the property was examined on August 4th development had only been started, so that but little could be seen. On the *Chance* claim a promising looking quartz vein is exposed in a small creek-bed. This vein is about 4 feet wide and is sparingly mineralized with iron sulphides. On the surface it is somewhat oxidized and there is a well-defined gouge on the foot-wall 4 inches thick. Selected samples from the surface outcrop are said to have shown fair gold values. At the time of visiting the property work was being started to strip this vein, but the surface outcrop had not been broken into. No other showings on the property were examined. Information as to the results of the summer's work has not been obtained.

Chisholm Property.—In September another location was made on Dome mountain by Alex. Chisholm; name of claim unknown. From the vein on this property the owner had some nice quartz specimens containing substantial "nuggets" of free gold. He reports that the vein is of fair size and with the evidence of values it should be well worth development.

Grouse Mountain.

Grouse mountain is one of the lower elevations of the Babine range, lying 15 miles south-easterly up the Bulkley valley from Telkwa. From the main road running along the Bulkley valley a rough road with steep grades extends nearly to the top of Grouse mountain, the distance being about 5 miles. The mountain is more or less flat-topped, the elevations running from 4,000 to 4,600 feet and being just about timber-line. On the upper elevations claims were staked some years ago on copper-showings. A number of these formed the holdings of the Cassiar Crown Copper Company, which company has carried on intermittent development work since its inception in 1915. A good description of the property is given in the Summary Report of the Geological Survey for 1915 by J. D. Mackenzie. The principal work done was a long crosscut tunnel and various drives and crosscuts from the main tunnel. This tunnel-work was unsuccessful in finding commercial ore-bodies or anything commensurate with the showings as exposed on the surface. It is now apparent that more surface work should have been done before driving the long crosscut tunnel. On the *Ruby* claim of the group some tunnelling was also done. This shows a fair body of mixed copper and zinc ore, which, however, is low grade.

Lakeview. This claim lies on the south side of a small lake which is on the plateau-surface of Grouse mountain. The owner is Louis Schorn, of Telkwa. The showings are somewhat similar to those on the adjoining Cassiar Crown property, consisting of sheared or sheeted zones carrying chalcopyrite and zinc-blende. The best showing is a zone 4 to 6 feet wide, which is well mineralized with chalcopyrite and exposed by surface cuts. It strikes N. 20° E. (mag.) and dips to the south at an angle of 40°. A grab sample intended to be an average one returned on assay: Gold, 0.02 oz.; silver, 9 oz. to the ton; copper, 6.2 per cent. There are other showings on the property and some further development would seem to be justified.

OWEN LAKE SECTION.

Owen lake lies about 28 miles in a direction a little west of southerly from Houston, a small town and railway-station 40 miles east of Smithers on the Canadian National Railway. For 16 miles of the distance out from Houston there is a road good enough for motor cars and the remainder to the lake is a very rough sleigh-road. This section lies in country which is a transitional zone between the Nechako plateau and one of the easterly ranges of the Coast mountains. It is characterized by rolling, undulating country, with here and there individual mountains of considerable elevations. The general elevation varies from 2,200 to 3,500 feet

and Owen lake is about 3,000 feet. On the south-westerly side of the lake, and rising from it, is Nadina mountain, which is a most conspicuous landmark, rising to an elevation of about 6,500 feet. It is the most prominent mountain in this part of the country and is visible from many places in all directions, up to distances of 50 to 100 miles. It is not due to any great height that this mountain is so noticeable, but because it is an isolated mountain of considerable magnitude rising much above the immediately surrounding country, which is, relatively speaking, of a flat rolling nature. Dawson refers to this mountain as Nadinaka mountain in his 1875-76 report.

In the neighbourhood of Owen lake the country-rock consists largely of plutonic and hypabyssal rocks, such as granite, gabbro, and diorite and gabbro porphyrites. Remnants of an older sedimentary series are visible in places, but these rocks are very considerably altered.

Claims were staked in this section more than ten years ago, but after a certain amount of prospecting many of them were allowed to lapse. The *Diamond Belle* and *Silver Queen* groups were kept up and the latter group was surveyed and Crown-granted. An option on both these properties was obtained in the fall of the year by the Federal Mining and Smelting Company and work on a small scale was commenced on the *Silver Queen* group. For a more extended description of this section *see* the 1916 Annual Report.

Silver Queen Group.

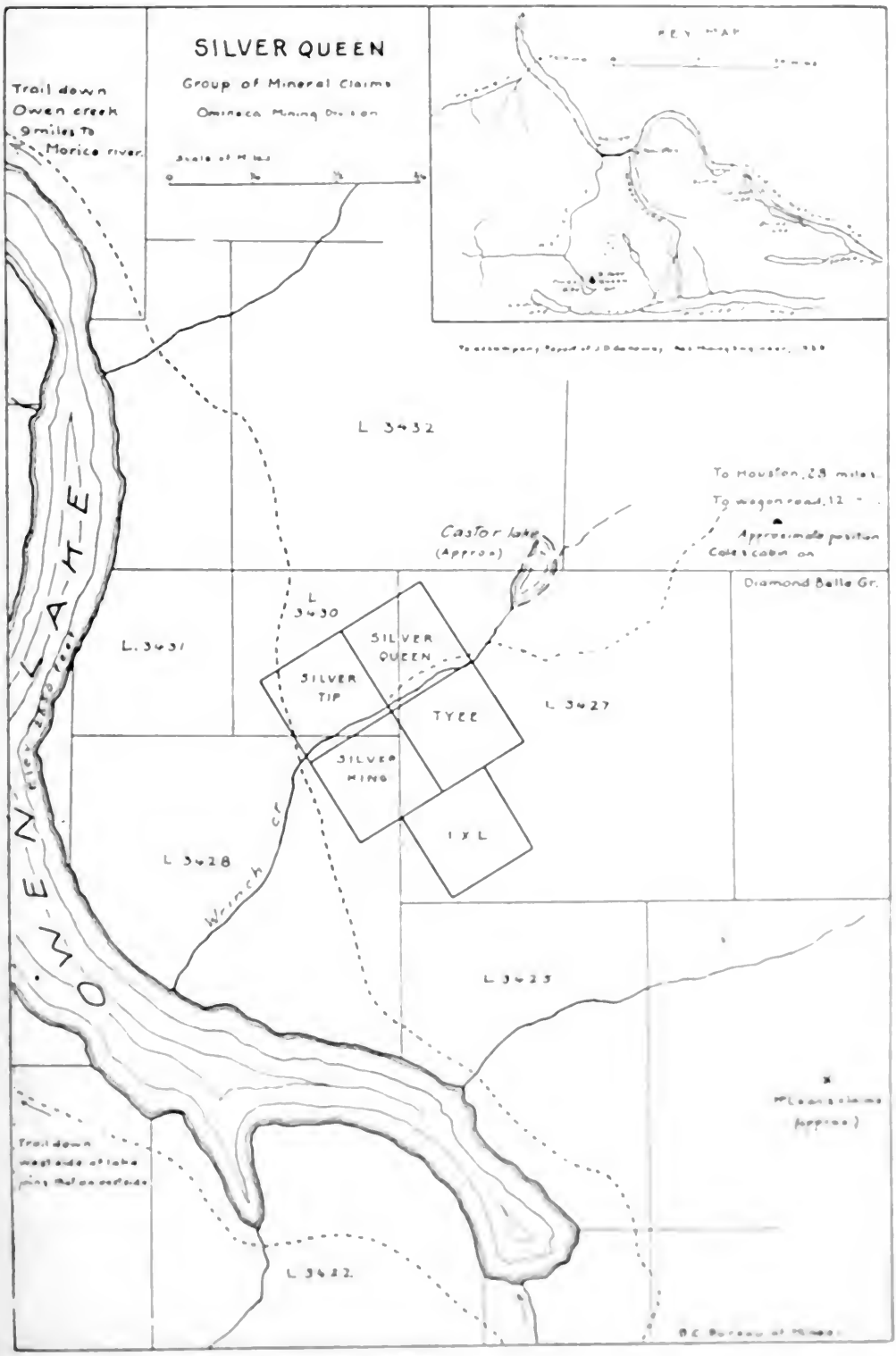
This group consists of the *Silver Queen, Silver Tip, Silver King, Tyee,* and *I.X.L.* Crown-granted mineral claims and is owned by Dr. H. C. Wrinch, of Hazelton. The property is situated on Wrinch creek, about a mile northerly from Owen lake, into which the creek flows. The main showings are distant about a mile from Cole's cabin on the *Diamond Belle* group. Wrinch creek is quite a small stream, which, however, in part of its course has cut a narrow steep-sided canyon about 200 feet deep into the country. It is along the sides of this canyon that the ore-showings on the property are exposed.

There are four or more veins or mineralized zones which cut across the creek nearly at right angles, or in a general direction of N. 60° W. (mag.) and dipping to the north-east. The general formation is apparently entirely igneous; near the veins and in them the rock is so badly decomposed that it is difficult to identify the rocks. Away from the veins the country-rock is fairly fresh and is generally porphyritic and basic; it ranges from diorite to gabbro porphyrite. The veins, so called, may be acid dykes that are sheared, altered, silicified, and mineralized. Quite a variety of metallic minerals are found, including pyrite, chalcopyrite, zinc-blende, and galena. In the different veins these minerals occur in varying amounts, sometimes one mineral predominating and again some of the others. Gold values are almost *nil,* but the silver content in many places is quite important. Of the base metals the copper is the most important, but the zinc may be considered as of some value later on as a by-product of milling operations. The development on the property consists of open-cuts and some short tunnels.

From assays taken in 1916 and also this year by the writer, and the sampling of the property by the Federal Company, it is apparent that widths of mineralized material in the veins or zones varying from 4 to 8 feet may be considered as ore. The silver assays run from 1 to 45 oz. to the ton, copper up to 8 per cent., and zinc up to 40 per cent. The gold values average about $1 to the ton. It is of course evident, when the location of the property is considered, that ore of this class would have to be concentrated before shipment. The character of the veins is such, though, that it is quite reasonable to expect that development will show sufficient tonnages of ore in them to keep a mill going. The ore is a complex one and will require a careful mill treatment.

The veins on the property are numbered from 1 to 4, with No. 1 being the lowest at the lower end of the canyon on Wrinch creek. Another vein called No. 1A lies at right angles to No. 1 and not far from it. It is either another vein or No. 1 with its strike very considerably deflected. No. 2 vein is about 200 feet up the creek from No. 1; No. 3, 150 feet higher up than No. 2; and No. 4, 75 feet above No. 3. No. 3 vein, which has been traced farther on the surface than any of the others, has been exposed for about 400 feet north-westerly from the creek by means of open-cuts.

None of these veins are well defined in the sense that they are fissures with clean-cut walls, but most of them are quite definite enough to follow and the mineralization is apparently


SILVER QUEEN
Group of Mineral Claims
Omineca Mining Division
Trail down Owen creek 9 miles to Morice river.
KEY MAP
L 3432
To Houston, 28 miles
To wagon road, 12
Approximate position Cole's cabin on
Castor lake (Approx)
Diamond Belle Gr.
L 3430
L. 3431
SILVER QUEEN
SILVER TIP
TYEE
L 3427
SILVER KING
I X L
L 3428
Wrench cr
OWEN LAKE
L 3425
Trail down west side of lake joins that on east side
L 3422

continuous and strongly defined. The No. 4 vein is the largest one, and where it is exposed to one side of a waterfall on the creek it is irregularly mineralized across 20 feet. At this place it contains some nice bands of chalcopyrite and the silver values average up well.

Development of the No. 4 vein was started by the Federal company in November, a diagonal crosscut tunnel being started from the foot of the falls. At a distance of 22 feet from the portal this tunnel cut the foot-wall of the vein; it was then turned and driven as a drift on the vein for 15 feet. The face showed 2 feet of material mineralized with disseminated pyrite and chalcopyrite and 2 feet of high-grade ore, mostly chalcopyrite, with a little galena and zinc-blende. No hanging-wall was evident in the drift, so a crosscut was started to determine the width of the vein. By the end of the year this was in 13 feet. The first 8 feet of this crosscut showed disseminated low-grade ore and the remaining 5 feet high-grade ore and no hanging-wall in sight. This makes a total width of at least 10 feet of low-grade ore and 7 feet of high-grade ore in the vein at this section. Work is being continued throughout the winter, and in the spring more extensive camps will be erected and a larger crew put on to develop all the showings.

Diamond Belle Group.

This property lies a short distance to the north-east of the *Silver Queen* group and is owned by J. Coles and partners. It is also under bond to the Federal Company. No work has been done on it yet by the company, but it is expected that development will be started early in the spring. The showings on these claims are similar in character to those of the *Silver Queen* group. There are at least three veins on it which are more or less parallel and are separated by distances of a few hundred feet. Mineralization is apparent across widths of from 2 to 5 feet and the veins may be wider. The same minerals are found as in the *Silver Queen* veins, but less chalcopyrite and more zinc-blende is found in the showings than in the latter property. Small specks of grey copper were noticed in one specimen. The silver values may be somewhat lower, as it is evident that the zinc-blende carries little or no silver. One sample showed $3.20 in gold to the ton.

The three veins are developed by open-cuts and shafts, the deepest of which is about 15 feet deep. On the surface the veins have been exposed at intervals for distances of from 200 to 400 feet. The outcrops of the veins are in country which is more or less level, with slight undulations, so that development will of necessity be by shaft-sinking.

McLean Property.

This group of two claims is a relocation of the property described in the 1916 Report as the "Chisholm property." No work has been done on it since that time and, as the shaft has water in it, but little can be learned by an examination. The ore-body does not crop out prominently on the surface, but it is evident from the dump from the shaft that much mineralized material was taken out in sinking the shaft. A grab sample of the whole dump assayed: Gold, 0.4 oz.; silver, 5.2 oz. to the ton; lead, *nil;* zinc, 20 per cent. A shipment of hand-sorted ore was packed out from this property in 1914 or 1915. It was, of course, too low grade to be handled at a profit, and it is quite apparent that only a mill concentrate with good transportation could be handled from this section. This property warrants some further development and an effort should be made to expose the vein on the surface along its strike. There is not much chalcopyrite in evidence in the ore, but it is quite possible that shoots of this mineral would be found similar to the showings on the *Silver Queen* group.

It is considered that the Owen Lake section is worth further prospecting. From the trip that was made through from Houston to Owen lake and on to the Sibola section in 1916, it is known that geological conditions are quite favourable for the occurrence of ore-bodies, and the showings at Owen lake show that it is a mineralized zone, so that it is quite reasonable to suppose that other ore-bodies may be found in the section.

Burns Lake Section.

An interesting discovery of asphaltum was made in this section during the year. The discovery is credited to E. M. Dotson and the find was made on the farm of Mrs. Oakla Collier, which is about 2 miles from the ferry-landing on the north side of Francois lake. The outcrop occurs on a side-hill a few hundred yards distant from Mrs. Collier's house.

The asphaltum occurs in a small "vein" or fracture in an andesitic rock and associated with a fibrous brown mineral, a phosphate of lime, which has not yet been definitely classified. The vein is from 4 to 12 inches wide and has been exposed at intervals for about 100 feet.

It has a strike of N. 55° E. (mag.) and dips flatly to the south-east. In its nature this vein is quite irregular and may represent a cooling fracture in the volcanic rock. It is apparent that the fracture was first partly filled with the brown mineral; later the asphaltum in a liquid or semi-liquid condition penetrated along the fissure and in places the brown mineral is soaked and permeated with the asphaltum.

The country-rock in the immediate vicinity of this showing is entirely of volcanic origin. It is always fine-grained, in some places well-weathered, and shows varying degrees of basicity. Many bands of it are vesicular and many of these vesicles are filled with small blue-white agates. Throughout the country-rock for distances up to 1,000 feet away from the "asphaltum vein" small specks of asphaltum were noted. It is quite apparent that this mineral came in after the rock was formed and occupied any small holes or cracks available.

Samples of the brown mineral and the asphaltum were submitted to the Geological Survey at Ottawa, and through the courtesy of the Director a very careful examination and analyses of these specimens have been made by officers of the survey. With regard to the asphaltum, the following report has been received:—

"*Bituminous Material from Francois Lake, B.C.*

"Sample submitted consisted of single lump of black bituminous material with considerable adhering mineral matter. A careful separation of this foreign mineral matter was made to obtain:—

No. 247Sa, 51 grams, with ash content of 0.7 per cent.
No. 247Sn, 39 grams, with ash content of 22.9 per cent.

"Analysis of No. 247Sa—

Colour	Black.
Fracture	Conchoidal.
Lustre	Vitreous.
Streak	Brown.
Specific gravity	1.06.
Melting-point (ball and ring test)	86° C. (187° F.)
Ash content	0.7 per cent.
Fixed carbon	21.5 per cent
Solubility—	
In petroleum ether	56 to 57 per cent
In carbon tetrachloride	90 to 100 per cent
In carbon disulphide	90 to 100 per cent

"According to the above analysis, the bituminous material of this sample is an asphaltic pyrobitumen. According to Abraham (*see* his text-book 'Asphalts and Allied Products,' page 480), it falls within the narrow sub-class of Wurtzilite asphalt, as well as in the broader class of native asphalt (containing less than 10 per cent. of mineral matter). The origin of these asphaltic pyrobitumens is given as derived from the metamorphosis of petroleum.

"Analysis by—

"H. KOHL, *Chemist*

"*R. E. Gilmore, Superintendent.*"

A preliminary report from Dr. Eugene Poitevin, Chief, Division of Mineralogy of the Department, on the fibrous mineral indicates that it is a phosphate, but that it may be a new mineral type. The final report has not yet been received.

The analysis on the asphaltum, which indicates that the material is derived from the metamorphosis of petroleum, checks with the field observations that the asphaltum entered the rocks in which it is at present found in a liquid condition; that is to say, as petroleum. It is quite apparent that the phosphate mineral was deposited in the small vein or fracture in the andesite after the volcanic rock cooled, as it is undoubtedly a mineral formed from precipitation from a water solution. It is also evident that the asphaltum mineral came into the vein after the phosphate was formed, as proven by the way in which the phosphate is encrusted and soaked with the asphaltum.

According to the generally accepted ideas of the origin of petroleum, the andesite rock could not have been the source of the petroleum from which the asphaltum has been derived, as it is held that petroleum has its source in the vegetal and marine life occurring with and during the formation of sedimentary rocks. So the ultimate source of petroleum is from a sedimentary formation, although it may after formation migrate to other rocks. It is probable that in this case the petroleum has migrated from some underlying sedimentary formation into the andesite and that in doing so it has been changed gradually into asphaltum. The important significance of this conclusion is that it is possible that somewhere in the vicinity of the asphaltum occurrence a formation containing commercial quantities of petroleum may be found. Another explanation, however, may be that the volcanic rock, andesite, while in the molten condition flowed over a sedimentary formation containing beds of lignite or other carbonaceous material, and that the heat from the molten rock has distilled off a petroleum substance which later consolidated to asphaltum. But this is not considered probable.

An outcrop of a sedimentary formation was noted about 300 yards to the south-west of the "asphaltum vein." This consists of a fairly coarse reddish conglomerate. Pebbles up to 3 inches in diameter occur in it, the majority of these pebbles being of a hard flinty rock. No andesite pebbles were seen. Without much field evidence and more or less as a guess, it is suggested that the andesite formation overlies and is younger than this conglomerate. A few hundred yards to the west of the conglomerate-exposure there is an outcrop of shale on the banks of a small creek. This shale is also of a reddish colour and very fissile. From its attitude it is believed that it is an upper member of the conglomerate formation. Sandstone-float was also observed, but none was seen in-place. Owing to limited time the examination of this section was only of a preliminary nature, but a more extensive one will be made during 1924.

Very little is known about the general geology of the country lying between Burns lake and Francois lake. It is known that there is a great profusion of igneous rocks, mostly volcanic flow-rocks and porphyries, but comparatively few outcrops of sedimentary rocks have been noted. Dawson classified the rocks of this section generally as belonging to the "Porphyrite group," now known as the Hazelton formation. The lower horizon of the Hazelton formation consists of volcanic rocks, but the upper horizon contains sediments and ash rocks. The age of the Hazelton is assigned as being from Jurassic to Lower Cretaceous. There are also some Tertiary volcanic rocks in the Burns Lake section and in places they are difficult to distinguish from the Hazelton formation volcanics. Sedimentary rocks in the section would probably be older than the Hazelton formation and for the most part covered up. Such older sedimentary formations may be the source of the petroleum from which the alphaltum has been formed, but very definite evidence of this would be required before any drilling would be warranted. A good deal of the country is covered with surface soil and vegetation, but a sufficient number of rock-outcrops could probably be found to admit of geologic mapping of the rock formations.

Provided that definite evidence of suitable formation for originating the petroleum was obtained, then considerations of structure would be taken up to find the most suitable place for drilling.

This deposit of asphaltum is of no commercial value. While asphaltum is of some value, it would have to be found in much larger quantities than in this deposit to be of any importance. It is, however, being used by the Francois Lake ranchers for caulking rowboats and canoes and is even said to be a satisfactory substitute for sealing-wax. The only important thing about the deposit is that it is a possible indication of petroleum in the rocks of the section. Summing up, it may be said that the asphaltum occurrence indicates petroleum in the rocks, and the outcrops of conglomerate and shale show that a sedimentary formation may underlie the volcanic formation which covers most of the surface.

The writer's attention was first directed to this deposit by D. M. Gerow, of Burns Lake, who for several years past has been prospecting for oil indications in the Burns Lake section. He claims that in other places there are said to be small outcrops of the asphaltum mineral, but none of these have been definitely identified and examined by him.

Oakla Group. The *Oakla* group of five claims is owned by Mrs. O. Collier, George Culp, E. M. Dotson, and Gladys Collier. It is situated about a mile north of Mrs. Collier's farm, or 3 miles from the ferry-landing on the north shore of Francois lake. There are several veins on the property which have been slightly developed by open-cuts. These veins consist of small fractures filled with gouge and with mineralization

radiating into the walls from the central fracture. The only important metallic mineral observed was pyrite and this only in small amounts. The country-rock is greyish green andesite and the gangue of the veins consists of this rock, together with a little quartz. Four samples were taken from different showings which were representative of from 2 to 6 feet of mineralized material. Only one of these showed appreciable values—namely, 0.54 oz. gold to the ton; this was from the most westerly showing, which is a fairly well-defined quartz vein, but small.

SIBOLA SECTION.

This section was not visited during the year as there was but little activity there. The *Emerald* group, which has an important showing of silver-lead ore, still remains in the prospect stage and is awaiting development. This property would undoubtedly have been developed long ago but for the difficulties of transportation. It is quite possible, however, that the transportation problem may not be as difficult to solve as has been considered by many. By using some of the low passes through the Coast mountains and bringing the ore to tide-water on Gardner canal a feasible route may be found.

The intense demand shown at the present time by scouting engineers for silver-lead properties may result in something being done with this group during 1924. Reports on the property can be found in the 1916 and 1919 Annual Reports. Any one wishing to examine the property should communicate with W. Sweeney, of Telkwa, one of the half-dozen owners of the property.

Some development was carried out by W. Harrison & Sons on the group of claims that they own on the mountain lying between Whitesail and Eutsuk lakes, known as the *Silver Tip* group. This property was described in the 1919 Annual Report, but only some of the less important showings were seen. The best showings of high-grade ore lie higher up the mountain and these were not examined. Information from the owners is that the summer's work was quite satisfactory and that an attempt will be made to take out a shipment of hand-sorted ore during the winter. Assays are said to show ore running several hundred ounces of silver to the ton, the silver-carrying minerals being ruby silver, grey copper, and galena. Ore of this character will stand the high transportation charges in getting it down the lakes and rivers and by wagon from Ootsa Lake settlement to the railway. An examination of this section is planned for next season by the Resident Engineer.

MANSON SECTION.

The term "Manson section" is used to designate that area of the Omineca Mining Division which in former years had some importance as a placer camp and which centred about the old town of Manson. In recent years this section has been practically dormant, but it attracted a little more attention during 1923, and it is expected that further activity will be in evidence during 1924.

Early in the spring the property of the Kildare Mines, which has been allowed to lapse, was acquired by H. Beech and P. O. Bangert. This property was worked years ago as a hydraulic placer mine and a large sum of money was spent in equipping it with the necessary water-supply. Although it is supposed to be good hydraulic ground, the old operations were not successful. During the year an examination and report on the property was made for the new owners by C. T. Cabrera. He spent several weeks at the property and made small-scale hand tests of the gravels at different points. His report says that there is a large yardage of gravel that will run at least $1 a yard and in places will go much higher. He strongly recommends that the opening-up and mining of the property be prosecuted with as soon as possible. It is believed that Messrs. Beech & Bangert are backed with ample capital to carry out the re-equipment of the property and that operations will be started in 1924.

After reporting on the property Mr. Cabrera severed his connection with the Beech-Bangert Syndicate and returned to the district the beginning of January, 1924. He is now representing the P.B.C. Company and will take a party into Manson section some time in March in order to look for and acquire suitable placer-ground for hydraulicking or dredging. Mr. Cabrera is very enthusiastic about the possibilities of this part of the district, and says that in addition to placer-gravels there are promising outcrops of gold-quartz veins and silver-lead deposits.

During the year there were a number of placer prospectors at work at a number of places in the section. One party of six Chinamen worked all season on Vital creek.

COAL.

Progress in coal-mining in the district was not evident during the first half of the year 1923, but the reopening of the Telkwa Collieries in the last half provides some encouragement. This property has been worked intermittently in recent years, mainly by leasers, but a more comprehensive development plan was started on a new seam this year.

So far as is known, no work was done on any of the other coalfields of the district during the year. The local and Prince Rupert market for coal is now of some importance, and as most of the coal-supplies are now coming from the Province of Alberta, it seems rather strange that more effort is not made to open up the coalfields of the Telkwa section. Reports on these coal areas can be found in previous Annual Reports, particularly the 1914, 1917, and 1921 Reports. The Aveling property, about 7 miles from Telkwa, has been idle for two years and it is well worth investigation. The principal owners of this property reside in England, but business in connection with it is handled by F. B. Chettleburgh, of Telkwa. Another promising property is that of the Copper River Coal Company, situated on the Zymoetz river, some 40 miles from Telkwa; it is controlled by the Yorkshire and Canadian Trust, Limited, Vancouver.

The important coalfield in the Peace River Division was examined during the year. In it there are several commercial-sized seams of high-grade bituminous and semi-anthracite coal, with a surprisingly low ash content. This field cannot be made productive until much better transportation is provided. A description of the coal-showings that were examined will be found under the part of this report headed "Peace River Division."

Telkwa Collieries.

This property is situated in the Telkwa River valley, 4½ miles up-stream from the town of Telkwa. The coal-seams on the property outcrop along the banks of Mud and Goat creeks. Both are small streams and the former flows into the latter just above its confluence with the Telkwa river. In former years the seams on Mud creek have been worked and small tonnages of coal have been shipped from these workings. At this point, however, the coal-seams are badly broken up and in many instances the coal only consists of small remnants cut off on all sides by erosion.

The most promising seam on the property is one on Goat creek, and this would probably have been opened up in the first place but for the fact that it was easier and less expensive to put a road in to the seams outcropping on Mud creek. The coal mined from the Mud Creek seams was hauled by sleighs and wagons to Telkwa and there shipped by rail. The last work was done by Gillespie & Wilson as lessees during the winter of 1922–23. The property then lay idle for a time until the opening-up of the Goat Creek seam was decided upon by Jack McNeil, of Telkwa. Mr. McNeil is one of the syndicate owning the property and he has made a working agreement of some kind with the other owners whereby he operates the property entirely himself.

The Goat Creek seam outcrops practically in the bed of the creek for a length of about 200 feet. It strikes east and west and has a dip of about 14° to the north. The seam varies from 6 to 8 feet; one 8-inch clay-band occurs in places, but as a rule most of the seam is fairly clean coal. Easterly from Goat creek the country is fairly flat and it is not probable that the coal formation is as badly broken as on Mud creek; minor faults and rolls may, however, be expected.

The first development of the seam was to drive an adit-drift on the coal for a distance of 140 feet. Then a drive was made for some distance to the east. As a result of this work and the natural outcrop of the seam it was evident that there was a few thousand tons of coal in sight. No more development was done for the time being and preparations were made to put the property in shape for shipping coal. A road three-quarters of a mile long was constructed to connect with an old road running into the main road up the Telkwa River valley and repairs made to the old road. Bunkers were erected and everything made ready so that coal could be hauled when sleighing commenced. By the end of the year about 1,000 tons had been shipped, and shipments will continue until the sleighing breaks up in the spring. It is impracticable to haul on the road except in dry weather in the summer-time or by sleighs in the winter. The towns of Telkwa, Smithers, and Hazelton have been supplied by this coal and the remainder goes to Prince Rupert. In the extraction of coal a certain amount of development is done, and by the end of the year the seam was sufficiently opened up to show that there is a considerable tonnage of coal available at this point.

Peace River M. & M. Co.—Milling Plant.

Peace River M. & M. Co.—Chute to Mine.

The following analyses give some idea of the quality of the coal:—

Description.	Moisture.	V C M	F C	Ash
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Average sample of outcrop, excluding shale bands, across 6 feet	0·98	33·9	56·0	9·5
Average sample across 5 feet at point 100 feet in tunnel, more coal above and below	0·50	28·3	54·4	16·8
Grab sample from east drift	0·60	28·5	63·6	7·3
Grab sample of dump of coal, mouth of tunnel	0·50	29·2	58·8	11·5
Grab sample of dump of lump coal	0·80	29·0	62·5	7·7

These samples show that this is a good grade of bituminous coal and not unduly high in ash. Where the ash content is high it is due to the inclusion of shale or bony coal. With ordinary care in mining, a product can easily be produced which will have a lower ash content than commercial requirements call for. As tested out in the district by consumers, this coal gives complete satisfaction as a domestic fuel and it is apparent from the analyses that it will be a good steam-coal. From the results of laboratory tests the coal is coking.

Mr. McNeil reports that the Prince Rupert market is willing to take all the coal he can ship, the limiting feature on shipments at the present time being transportation. It is evident that no great tonnage of coal will ever be handled by means of hauling in wagons and sleighs over an indifferent road for a distance of 5 miles to the shipping-point on the railway. But if the seam is proven by development to be continuous and the market warrants it, a branch railway from Telkwa might be secured.

CARIBOO MINING DIVISION.

The important work in the Cariboo Division is placer-gold mining, and most of this is done in the Barkerville section. The season of 1923 was an unfortunate one for the placer miner, as, owing to an unusually dry year, the supply of water for hydraulicking and ground sluicing was much less than in normal years. Despite this handicap fair success was attained, as in at least some instances higher-grade ground was washed than in former years. The most encouraging feature of the year was the testing by Keystone-drilling that was carried on to prove certain areas of ground believed to be suitable for dredging. W. A. Johnston, of the Geological Survey, continued his investigation of the placer-deposits of the district.

BARKERVILLE SECTION.

Hopp Mines. Two properties, *Louhee* and *Mosquito Creek*, were operated by John Hopp during the season. It is reported that better grade ground was handled on the *Louhee* property than in recent years, and this compensated for the limited water-supply, which reduced the yardage handled below that of a normal year. It was expected that the *Louhee* flume, which is nearly a mile in length, would be paved with steel plates to replace the wooden blocks at present in use. This work was planned for 1923, but was not carried out; all arrangements, however, have been made to do it in 1924. The object of using steel plates for lining the flume is to allow of using a flatter grade so as to bring the head of the flume down to bed-rock in the pit. During the last two seasons the head of the flume has not been down to bed-rock in the pit, which makes it difficult and impracticable to satisfactorily clean bed-rock, with a consequent loss of values.

Devil's Canyon.—This is a small hydraulic property run by Houser Bros. A successful season is reported with a limited water-supply. This property was opened up two years ago and results to date have been quite satisfactory.

Waverley. The *Waverley* hydraulic mine is an old property situated on Grouse creek, 4 miles from Barkerville. It was worked for years and then lay idle for a long time. Some years ago it was acquired by the New Waverley Hydraulic Mining Company and three seasons' work was done in an effort to find a continuation of the old pay-gravels, but without success. Drilling was also done, some of this being by the Government. No very satisfactory results were obtained in any of the work, although one drill-hole

showed some low-grade ground, and other holes close to the old pit also showed fair values. Some further small-scale work was done by ground-sluicing and encouraging results were obtained. As a result further drilling is to be done by C. W. Moore, manager of the company. This drilling will be started in January, 1924.

Other Placer Properties.—Hydraulic operations were carried on at the *Point* mine on Slough creek, Perkins gulch, near Stanley, on Cunningham creek, and 8-Mile lake, besides small-scale work by individual miners. The extreme shortage of water throughout the district only allowed a short working season on the various properties, with a corresponding small yardage handled.

Lode-mining.

Lode-mining in this section is still marking time, as there was but little work done excepting annual assessment-work. On the *Rainbow* group work was carried on all season by the owner, A. Sanders. This property has a small quartz vein which in places is well mineralized with free gold. This free gold probably results from the oxidation, at and near the surface, of auriferous pyrite and arsenopyrite in the quartz. The owner selects the best ore and after rough crushing pans out the gold. By this means he has been doing quite well during the past two seasons.

Work was commenced on the *Hudson* group on Cunningham mountain in March and a tunnel driven. Development was stopped in May and no information is available as to the results obtained. The property is owned by E. Moore and Fred Wells and described in the Annual Report for 1922.

A quick examination of some of the properties on Proserpine mountain was made during the summer by J. F. Duthie and his engineer, J. R. Turner. A number of inquiries have been received by the Resident Engineer regarding the quartz-showings in the Barkerville section and it is expected that some of the properties will be examined in 1924.

Keystone-drilling.

One of the promising signs for the future of the Barkerville section was the Keystone-drilling campaign carried out by W. E. Thorne in the interests of English capital. The object was to prove up, if possible, certain areas of gold-bearing gravels which would be suitable for working by dredging methods. Leases on Cunningham creek, Cunningham pass, and Antler creek were drilled and encouraging results are said to have been obtained. These leases are held by various individuals, but Mr. Thorne had them tied up in some way so that his company could secure them if the drilling results proved satisfactory. Negotiations were also pending between Mr. Thorne and John Hopp for the dredging area controlled by the latter on Williams creek, but up to the end of the year no deal had been arranged. This area has been drilled and check-drilled in former years, from the results of which it is estimated that there are several million cubic yards of gravel running 25 cents a yard within depths of 40 to 80 feet. Mr. Thorne expected to carry on drilling throughout most of the winter and it is possible that a dredge will be erected on some of the properties in 1924.

Further Keystone-drilling of the *La Fontaine* mine was started in November by L. A. Bonner. This is an extension of the drilling done by the Government, details of which can be found in the 1922 Annual Report.

Testing of the gravels in the Swamp River section by drilling is to be carried out in 1924 by A. F. Brown. A hand-power drill will be taken in over the snow in the winter and early in the year drilling will be started. This section has been but very slightly prospected for placer gold and Mr. Brown considers it worth exploring to some extent. It is considered that drilling is the cheapest and most efficient way to carry out this prospecting.

Lightning Creek Gold Gravels and Drainage Company, Limited.

The Lightning Creek Gold Gravels and Drainage Company, Limited, controls some 20 miles of placer leases situated on lower Lightning creek; a number of the leases acquired by the company were consolidated into one group by private Act in 1896 (chap. 56 of 1896). Other interlocking companies are connected with the enterprise in some way, but the exact relation of one to the others is not known. These other companies, however, with the exception of the Wingdam Company, Limited, are foreign corporations not registered nor licensed to do business in British Columbia. These companies therefore have no legal status in British Columbia, and

attention in this report will be confined to the Lightning Creek Gold Gravels and Drainage Company, Limited.

Lightning creek, on which the company's leases are held, has its source above Stanley and near Barkerville. The large output of gold from this creek in the pioneer days was from the upper reaches above and in the vicinity of Stanley, where up to the present the important productive area has been limited to a stretch of about 3 miles. The main operations of the Lightning Creek Gold Gravels and Drainage Company, Limited, are at Wingdam, which is 28 miles from Quesnel on the road to Barkerville and about 20 miles below the town of Stanley.

Since its inception this company has carried on intermittent operations at Wingdam within a distance of about 2 miles along the creek, and in the aggregate a large amount of work has been done. As a result of operations in 1919–20 the company went in debt for wages, cordwood, and supplies, and some of these accounts and judgments which were secured still remain unpaid. In 1913 a series of debentures, being a first charge against the property, was duly authorized and issued by the company; these debentures and interest being unpaid on November 28th, 1921, by an order of the Supreme Court, H. W. Dyson, general manager of the Yorkshire and Canadian Trust, Limited, Yorkshire Building, Vancouver, B.C., was appointed receiver for the debenture-holders, and as such placed H. Jones in charge of the property at Wingdam.

In all, a large sum of money has been spent on the property, variously stated at from $750,000 to $1,250,000. Several shafts have been sunk, extensive camp buildings have been erected, and flume-lines to convey water from Lightning creek have been built. Much pumping machinery has been installed on the property, the power to run which is partly supplied by water-power and partly by steam-boilers.

Work has been carried on by the company at the property for many years past, but some years all work was suspended. Operations consisting of Keystone drilling, construction-work, or shaft-sinking were carried on in 1917, 1918, 1919, and 1920. Practically nothing was done in 1921 and 1922, but in 1923, by arrangement with the receiver, operations were resumed. Repair-work and new construction were carried on for a few months, but no actual mining was done. When the property was visited in November operations had practically been stopped.

The gravel-deposits that this company has been attempting to mine consist of a considerable thickness of gravels and clays in the valley of Lightning creek. The class of mining carried on is known as "deep-drifting methods," in which only the bed-rock gravels are mined. The width of the channel at Wingdam is estimated to be about 100 feet and the average depth from the surface to bed-rock at the centre of the channel is about 165 feet. In this type of mining shafts are sunk, either in the channel or in the rim, to a depth slightly below the lowest point in the channel, and the bed-rock gravels are mined out by means of drifts and crosscuts from the shaft. As a rule, a height of about 6 feet of gravel lying on bed-rock is extracted, and after hoisting to the surface this gravel is washed in the ordinary way in sluice-boxes. It is evident that in mining of this nature high-grade gravel must be obtained, as the yardage of gravel handled is relatively small and costs per yard are consequently high.

The questions of importance with regard to this property, aside from management, are what gold content the gravels carry and how can the gravels be economically mined.

Regarding the values in the gravels, in the writer's opinion, extravagant and misleading statements have been made in past years in literature issued for the company. The rich placer-ground—bed-rock gravels—which was worked out in the vicinity of Stanley, 20 miles up Lightning creek from Wingdam, in the early days of the Cariboo gold-rush, is quoted as evidence indicating that the lower part of Lightning creek controlled by the company should be correspondingly rich. This inference, however, does not necessarily follow. Of much more importance in determining the value in the Wingdam gravels is the testing by Keystone-drilling that the company has carried out. Several cross-sections of drill-holes have been made across the channel of Lightning creek in the vicinity of Wingdam, and the results from all this drilling should give a fair indication of the values contained in the gravels at the points drilled. A consideration of the available reliable information with regard to the results of this drilling would seem to show that some of the gravels contain values, but whether sufficient to work at a profit under the conditions is not yet proven. Values in the overlying gravels are also claimed, but for the present these can be disregarded, as the method of working would be, for the most part, to work out only the bed-rock gravels.

The difficulties involved in mining the bed-rock gravels at Wingdam are due in large part to the heavy flow of water through the gravels in this part of Lightning creek, with a consequent

heavy water-pressure in the gravel-faces of any shafts and drifts. Commenting on this, B. R. MacKay, of the Geological Survey, Canada, in his 1918 Summary Report, says:—

"The great depth at which these deposits lie, and the excessive flow of underground water encountered, are the chief handicaps to the working of these deposits. Although the company has been engaged for a number of years in trying to master the situation, the difficulty is not yet solved."

At Wingdam four or more shafts from 100 to 200 feet deep have been put down. According to the company's statement, two of these shafts are in working condition and practically ready for operation. Drives have been made from these shafts out into the gravel, but owing to heavy water-pressure these workings, at least in some instances, could not be maintained. No actual mining of gravels has as yet been done from any of these drifts from the shafts into the gravels. In this connection the B.C. Minister of Mines' Annual Report for 1902 contained the following, which is an extract from the manager's report to the company:—

"We were then breaking through with the last drive—in fact, had broken through some little time and were going through the gravel—when we had a sudden rush of water with considerable slum in it, which was more than the pump could handle."

For several years after 1902 the company devoted its attention to equipping the property with more pumping machinery and with testing the gravels by means of Keystone-drilling. Shafts were worked or sunk after this time, but up to the present no success has been achieved in drifting out into the gravel-filled channel. It should be remembered that the company has not operated continuously, but only when money was available. As soon as a good start had been made at operation, either the money would play out or the local manager would be discharged and all work would be stopped for a time. The history of the company is a record of repeated starts and stops, with much purchasing of new machinery and equipment. Confident promises of better luck with new pumping machinery and new development plans are repeatedly given in literature issued for the company, but no continuous efficient development system has ever been carried out by the management. The results so far attained are not commensurate with the amount of money that is stated to have been spent. The repeated starting and stopping of operations have used up a lot of money, with but little to show for the necessary expenditures.

It has always been maintained by the company that, if sufficient pumping equipment is provided and the water taken out at two or more shafts, the water-pressure would be sufficiently lowered so that mining might be carried out. But it is significant that up to date practically no actual mining of gravel has been accomplished. It is quite possible that with requisite pumps and efficient management the ground can be mined. It is also quite apparent that the costs per yard of gravel mined, owing to the conditions referred to, will be high. Whether or not the gold content of the bed-rock gravels is high enough to yield a profit after this cost is a question which still remains to be proven. Regardless of the merit of the property, when it is remembered that this company has been operating for over twenty-five years without producing appreciable gold or any profits, it is quite apparent that the mining business of the company has not been very efficiently handled.

Tertiary.

This property is situated at the foot of the Cottonwood canyon on the Fraser river, 18 miles above the town of Quesnel. The property is owned by the Tertiary Gravel Company and was described in the 1917 and 1918 Annual Reports. The deposit of auriferous gravel which has been worked consists of a tightly cemented gravel which in places is practically conglomerate. The company put in a plant to crush and treat this gravel and the mining was done by machine-drills. In its operation the property was more of a rock-mine than a gravel one. No great success was attained by the company even when the crushing was modified so as not to crush the pebbles in the cemented gravel.

The last work done by the company was in 1922 under the supervision of D. D. Fraser. In 1923 Fraser and McCarty obtained a working arrangement of some kind with the company and were themselves working the property. When the mine was visited in May they had taken out about 1,500 mine-cars of dirt and were washing this with a small stream of water. The plant was not being used, the cemented gravel having been sufficiently broken up by mining and weathering to get most of the values out without further crushing or trommelling. A car of dirt is about a cubic yard and the values were running about $1 to $1.50 a car. The gold is

coarse but not nuggety; occasionally pieces up to $2 in value are found. The pay dirt consists of about 6 feet of gravel from bed-rock up, with probably some concentration of values on the bed-rock. There are many quartz pebbles in the gravel and some large boulders. A further operation of the property is expected either by the company or the lessees.

Fort George Section.

By the Fort George section is meant the northern and eastern parts of the Cariboo Division that are naturally tributary to the town of Prince George. Not much mining activity was apparent in this section during 1923. Some placer-mining was done on 6-Mile creek, a small creek flowing into the Fraser river south of Prince George. Development of the *Snowshoe* group was started in the fall and carried on during the winter. Assessment-work was done in a number of places.

Snowshoe Group. This group of claims, which is situated about 15 miles north-easterly from Prince George, was described in the 1918 and 1922 Annual Reports. The property is being developed by a syndicate consisting of A. Hutchinson, William Bonner, Wallace Cheer, George Williams, S. J. Watson, M. Framstad, and W. L. Armstrong. The property was not visited in 1923, but the following information has been obtained from a letter from one of the members of the syndicate: "The *Snowshoe* group consists of eight claims about 5 miles south and east of Shelly Station, the claims being held under a partnership agreement. At the time the partnership agreement was formed last fall a 20-foot shaft had been put down on the property. We deepened this another 20 feet and uncovered ore all the way, running about 3 per cent. in copper. As this was not satisfactory we stopped work in that particular shaft and commenced on an abandoned one about half a mile away. We went down on this 17 feet to a depth of 27 feet and ore taken at this depth assayed $23 in gold, silver, and copper (at present values), and had widened out from a stringer to 3 feet wide, with evidence of still further widening when our men had to stop on account of water. We then decided to get a pumping plant and go farther on that shaft. It was just before Christmas when this was up and ready for operations. The men then came into town and we sent them out about ten days ago to work on the shaft until the end of March."

QUESNEL MINING DIVISION.

The only important mining in the Quesnel Division is placer-mining, although prospecting for lode minerals is intermittently carried on. Coal-deposits are known, but as yet very little development has been done on them. Owing to the production of the Cedar Creek camp the placer-gold output of this Division for the last two years has shown a large increase over previous years, and the interest aroused by the rich ground at Cedar creek has had a very beneficial result on prospecting. During the year some attention was paid to the deposits of diatomaceous earth (sometimes called infusorial earth) near the town of Quesnel. These deposits have long been known to be of good quality and considerable size, but nothing has been done with them owing to lack of market. It is now claimed that a possible market exists at Vancouver, and so leases covering some of the deposits were taken up by Messrs. Vaughan and Haggen. A good description of these occurrences of infusorial earth can be found in Memoir 118 of the Geological Survey, Canada, by Leopold Reinecke.

During the year grants were made from the Mines Development Fund for the purpose of improving the transportation in the Quesnel Lake section (which includes Cedar Creek camp) and the Keithley section. Substantial grants were also made by the Public Works Department for repairing the main trunk road serving these sections and a bridge was built across the old dam-site at the foot of Quesnel lake. This part of the Division is now therefore well served by fairly good motor-roads throughout.

Quesnel Section.

Coal.

Outcrops of lignite at different points in the Quesnel section of the Cariboo Division have been known of for many years. A number of these were examined by the Resident Engineer in 1923. Very little attempt has been made to mine these coal-seams and in most places

practically no development-work has been done on the outcrops. From the analyses it is apparent that the coal is low-grade lignite and somewhat high in ash. Some of the seams are thick enough for mining, but the low grade of the coal makes it improbable that it would ever find more than a limited local market. Whether exploration or development of the field, by drilling or otherwise, would show better coal in the known seams or new seams containing higher grade coal is problematical.

Information about these lignite-deposits is given by Reinecke in Memoir 118 of the Geological Survey, Canada, "Mineral Deposits between Lillooet and Prince George, British Columbia." The coal occurs in the Fraser River formation, which is of Tertiary age. It is not probable that the different outcrops of the coal-seams from Quesnel to Alexandria show a continuous coal formation underlying the surface material and forming one large coal-basin, but it seems more probable that there are a number of small coal-basins throughout the area.

The places where the coal was examined were: One mile north of Quesnel and on the east bank of the Quesnel river; on Australian creek, on the Australian ranch, 21 miles south of Quesnel on the Cariboo road and 1½ miles from the Fraser river; on the east bank of the Fraser river 1½ miles from Howard's ranch; and at the Alexandria ferry about 800 feet south of the eastern landing. At all these places the character of the coal is much the same and the seams vary from 2 to 15 feet thick. Much of the coal in the seams is dirty and only portions of the seams could be used.

North of Quesnel.—This seam outcrops almost in the bed of the river and would be covered at high water. It is lying nearly flat and is from 2 to 4 feet thick. A sample across 3 feet showed that it is very dirty coal. This seam as at present showing has no coal of commercial value.

Australian Creek.—The coal-seams exposed on Australian creek are described by Reinecke in his report. An incline has been driven on one seam going down the dip for 60 feet; this work was done by Yorston Bros., of the Australian ranch. Some of the coal taken out was used as domestic fuel by them for a time, but as this has been discontinued it would seem that the coal is not very satisfactory.

This seam strikes N. 35° E. and dips at 20° to the north-west. It varies from 3 to 4 feet in thickness and contains thin seams of clay, which appear for a short distance and then disappear and then others take their place. The coal is typical lignite and contains so many shale-bands that it would require careful mining and sorting to produce fairly clean coal. Other seams crop out above and below the one on which the incline was driven. They are exposed on the banks of the creek, but none of them look any more promising than the one which was worked.

Fraser River, 1½ Miles from Howard's.—This coal is exposed at a point in the bed of the Fraser river where the river is split into two channels by an island. The coal occurs on the east side of the eastern channel; at high water it would be covered. The seam lies nearly flat and is from 4 to 5 feet thick. Clay-bands are of frequent occurrence in the seam and the analysis of selected lumps shows that the coal is high in ash, too high for commercial use. The only work done at this place is a small hole in the coal a few feet deep.

Alexandria Ferry.—This seam is the most promising of any that was examined. It is about 15 feet thick, but only part of it can be considered as being coal. It is well exposed near the foot of a high bank on the Fraser river about 800 feet south of the Alexandria ferry, on the east side of the river. The top 6 feet of the seam is dirty coal and clay-bands, then there is 2 feet of clay or shale, and next a middle bench of 4½ feet of coal; the bottom bench is 4 feet thick, separated from the middle one by 1½ feet of shale.

The analyses of samples from this seam show that it contains some coal not excessively high in ash and by selective mining or sorting a product should be obtainable low enough in ash for commercial use. A small hole has been made in the seam, but practically no development has been done. Slight improvement in the quality of the coal might be found on further development by getting away from surface conditions. As this seam is on the same side of the Fraser river as the Pacific Great Eastern Railway and not far away from it, small-scale mining of it might be successful in supplying the local market in the Cariboo.

The following table gives the results of analyses of the different samples taken:—

Description.	Moisture	V C M	F C	Ash
	Per Cent	Per Cent.	Per Cent	Per Cent
Selected lumps, seam north of Quesnel	2 8	36 8	25 4	35 0
Seam near Howard's ranch, selected lumps	3 6	40 2	35 6	20 6
Seam, Australian creek, average across 4 feet in incline	5 6	36 8	37 0	20 6
Seam, Australian creek, average across 4 feet in another place in incline	8 7	35 4	37 1	18 8
Alexandria ferry, average sample across 3 feet 6 inches in middle bench	6 9	39 7	39 7	13 7
Alexandria ferry, average sample across 4 feet in middle bench	5 1	38 2	38 5	18 2
Alexandria ferry, average sample across 4 feet in bottom bench	3 4	38 8	36 8	21 0

The high percentage of moisture and volatile combustible matter shown in the above analyses indicates that this coal is a low-quality lignite. The ash content is high, but might be reduced by sorting out clay-bands.

QUESNEL LAKE SECTION.

The name "Quesnel Lake section" is used to designate the country adjacent to Quesnel lake and the two forks of the Quesnel river and includes the Cedar Creek camp. Throughout this section much prospecting and small-scale placer-work was carried on during the season of 1923, in addition to the larger operations at Cedar creek. Prospecting of lode-mineral claims was also in progress in the vicinity of Cedar creek.

Spanish Creek.—The old hydraulic property near the mouth of Spanish creek that was worked in former years was acquired in 1923 by the Wright Syndicate. By October re-equipment had been completed and hydraulicking was started. Only a short run was possible before the winter freeze-up. A full season's run should be obtained in 1924 and it is expected the pit will be into pay-ground.

Thompson & Dalton.

This property is situated on the Spanish Creek road, three-quarters of a mile from Quesnel Dam and on the hillside overlooking the end of Quesnel lake. It consists of two placer leases and one record claim, owned by Thompson & Dalton. The owners took up the property in 1922 and since that time have made much better than wages by means of small-scale sluicing operations. In the summer of 1923 the property was acquired under option by the Murray-McGregor Company, but no work was done by the company.

Some of the ground covered by these leases was worked many years ago, but the present owners have opened up new places. The placer-deposits consist of shallow gravels lying on a sloping side-hill draining down into Quesnel lake. Glacial gravels form the greater part of the deposits, but in places there are well-weathered, reddish gravels containing pyrite crystals, some of which are altered to hæmatite. These latter gravels are probably Tertiary gravels, which at least in part have been reworked by glacial and stream action and mixed with glacial gravels. The Tertiary gravels occur in patches on the side-hill (not necessarily in the place where they were formed) and represent remnants of these ancient gravels not entirely removed by ice-action.

The supply of water for washing is quite limited on this property and consists of small short creeks which dry up in the latter part of the season. By putting in more extensive dams and ditches more water could probably be secured. It is not known whether the Murray McGregor Company has exercised its option to purchase the property.

Hardscrabble.—This placer property, which lies just above Quesnel Dam, was again worked in 1923 by the owners, King & Ramsay. No information has been obtained regarding results.

CEDAR CREEK CAMP.

The production of the Cedar Creek camp for the year 1923 was approximately $113,000, the greater part of this being made by the Cedar Creek Mining Company. This amount is slightly greater than for 1922. A still greater production would probably have been made but for the unfortunate fact that the Cedar Creek Mining Company suspended operations for a time owing

to financial difficulties. The only mining operations in the camp were those of the Cedar Creek Company and McGaskill & Wright on the Platt lease. Much prospecting of the area was carried on, but only by individuals using hand methods. Seepage-water on the high-level plateau area makes this work very ineffective, as it is only occasionally that bed-rock can be reached. No new discoveries were reported, but the rich ground on the Sheridan lease was proven by the Cedar Creek Company to be of considerable magnitude.

A fairly full description of the Cedar Creek camp was given in the Annual Report for 1922, so that only the work of the year 1923 need be outlined. As a result of a careful and detail examination of the camp in 1922, an excellent report has been made on it by W. A. Johnston, which appears in the Summary Report, 1922, Part A, of the Geological Survey, Canada. The important "Summary of Conclusions" from this report is as follows:—

"The rich pay-gravels being mined on the west side of the discovery draw are older than the glacial drift. They are distinguished from the glacial drift by their reddish colour and weathered character. They appear to be in-place, but this is open to question. If they are in-place they indicate the occurrence of an old stream-channel at the level at which they lie. The continuation of the channel, therefore, should be looked for at about the same level. It is possible that the pay-gravels extend through the greater part of the Stevens claim, for the ground is only gently sloping. If so, and provided the present values hold, they may contain upwards of a million dollars in gold. It is not to be expected that they extend towards Cedar creek and Quesnel lake much beyond the Stevens claim, for here the ground drops away rapidly. The ancient valley probably extended from the Stevens ground towards the present outlet of Quesnel lake and nearly coincided with the present valley of the lake in its lower part from Cedar creek to the outlet. In this stretch the ancient valley was first lowered by stream erosion and was later deepened by ice erosion, so that the gold which it contained became mixed with the drift and was later concentrated by stream actions in the bars and benches near the outlet of the lake. Above the Stevens claim the ancient valley probably extended along the west side of the broad upper part of Cedar valley, the main part of the valley being below the level of the gold occurrences. On the other hand, it is possible that the gold-bearing gravels have been moved to some extent by the glacial ice that moved across the region. The general direction of ice movement in the area is not definitely known, but judging by observations in the region lying to the north it was towards the south-west or across the upper part of Cedar valley. This movement, however, was slight, the main movement being in the direction of the Quesnel Lake valley, toward its outlet. The failure to find pay-gravels along the valley above the lower part of the Sheridan claim may be due to lack of prospecting, or to the effects of glaciation, or to the fact that the ancient gravels are gold-bearing only in places. Whether the gold-bearing gravels that are being worked are in-place can be definitely determined only by observing, during mining operations, whether the bed-rock is glaciated, whether the gold extends down in the bed-rock, and whether the pay-gravels are mixed with the drift. It cannot be said that the upper part of the supposed channel has been thoroughly prospected. This can probably be done only by drilling, because of the difficulties—in sinking—of controlling the water. Since rich pay-gravels occur at a high level above the present drainage in the Cedar Creek area, and since occurrences of this sort were not known, nor looked for to any great extent, while this general region was being prospected for placer gold, intermittently since 1859, the Cariboo district is evidently still worth prospecting."

Cedar Creek Mining Co.

The Cedar Creek Mining Company was organized in June, 1922, to take over and operate the Stevens and Sheridan placer leases in the Cedar Creek camp which had been acquired under option by F. S. Munson. Mr. Munson was the promoter of the company and became president and managing director of it. According to the option the purchase price of the two leases was to be $150,000, with a possibility of a further "bonus" of $30,000 if the purchase price was not paid in full by a certain date. The company also obtained an option on four other leases, but no work has been done on them. The two leases and also the other four leases were collectively owned by Stevens, Sheridan, McCullom, Grogan Bros., and McMahon. The option on the first two called for continuous operation of the property and the payment of 60 per cent. of the gross production of gold every week to the six owners, to apply on the purchase price.

Under this arrangement the property was worked by the company until about May 31st, 1923. By that time the company was considerably in debt for wages and supplies and liens had

B.C. Bureau of Mines

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been filed by the creditors. By order of the Court the Prudential Trust Company of Vancouver, was appointed receiver for the company and the business of the company was therefore administered by the receiver during the remainder of 1923. For a short time Joseph Wendt, a practical placer operator from Barkerville, was in charge of operations at the mine for the receiver. Later on, G. C. Bagley was appointed manager. B. F. Petch, as accountant, represented the Prudential Trust Company at the mine.

The Cedar Creek Mining Company was a private company, with 501 out of 517 issued shares held by F. S. Munson. In order to finance the company, "units" were offered to the public which had a par value of $10. In all, a little over $35,000 was realized by the company by the sale of 34,285 units, but it is to be noted that 25,000 units were "sold for otherwise than in cash." As the unit system was not particularly satisfactory, the receiver, under Court order, proceeded to reorganize the company. The capitalization was increased to 100,000 shares of a par value of $10, and the unit-holders are expected to exchange their units for shares.

Steady operation of the property with a crew of from forty to seventy men was carried on by the old Cedar Creek Company during the first five months of 1923. After the suspension of work in May and the appointment of the receiver but little was done in June, July, and August. From September to the end of the year operations were gradually increased. Somewhere about October an option was given by the receiver to the Murray-MacGregor Mining Company for the purchase of 37,000 shares of the reorganized company. The following information has been obtained in a letter from Geo. S. Gamble, manager of the Prudential Trust Company, acting as receiver, dated February 20th, 1924:—

"There seems to be a general impression abroad that the Murray MacGregor Mining Company is operating the mine. This is not the case. The mine is still being operated by the receiver, with George C. Bagley in charge. All surplus gold coming from the property is used entirely for the benefit of the Cedar Creek Mining Company. The Murray-MacGregor Mining Company has not completed its contract in which it agreed to purchase 37,000 shares for the sum of $125,000. The contract is past due and they have paid up to date $35,000. All threatened litigation has been cleared away; all liens paid. The balance of the 'Big Six' contract (option with the owners) has been extended in the form of a first mortgage on the property, with payments every sixty days, which payments up to the present have been met. At the present time there are some twenty men working on the property and for the last three weeks there has been an average of 20 oz. of gold recovered a day."

It seems advisable to explain why the old Cedar Creek Mining Company went into the receiver's hands, as at first sight the partial failure of the company gives a "black eye" to the property. The company undertook to buy the property in a little over a year by means of the gold extracted from the ground, supplemented by the sale of units to the public. Owing to the desire to rush the production of gold, no very efficient method of mining was adopted, with the result that heavy expenditures were incurred. As it was, by May 31st about $110,000 had been paid to the owners of the property by means of the 60 per cent. of the gold production. Unfortunately the 40 per cent. retained by the company did not equal the costs of production. During the winter of 1922-23 up to seventy men were employed by the company and the work was rushed as much as possible; economical mining was not possible under these circumstances.

The organization of the company provided for a limited stock issue, which was mainly held by F. S. Munson, and the issuing of "units" which were sold to the public. It is apparent that the terms under which these units were offered for sale were not particularly attractive to the public, regardless of the merits of the property. About $35,000 was raised in this way, but under different arrangements sufficient capital to buy and equip the property for effective mining might have been obtained.

The receiver's statements show that production from the property in 1922—June to December, inclusive—was 6,153 oz., and for the full year, 1923, 6,016½ oz. At the average value of $17 an ounce the total production of the property to the end of December, 1923, was therefore $206,561.50. Considering all the circumstances, this is quite a satisfactory record for the property, and the troubles of the old Cedar Creek Mining Company must therefore be ascribed to indifferent methods of finance, business, and management. It is only fair to point out that all management was generally from the Vancouver office, and that C. Muir and Major Day, superintendent and engineer respectively at the mine, had but little authority to handle the work as they thought best.

From June to October only intermittent work with rockers was done, but from then until the end of the year the steam plant on the Stevens lease was in operation. This steam plant, which was erected in 1922, consists of a steam-boiler using cordwood as fuel and a pump. Seepage-water is collected in a large reservoir at the lower end of the Discovery draw and is pumped from this point to the head of the line of sluice-boxes. The water after being used for washing gravel returns to the main reservoir and a fairly steady supply is thereby maintained. The gravels on the Stevens lease have always been mined by hand methods and are moved by wheelbarrows to the head of the sluice. The system is to remove the upper barren or low-grade gravels and dump them to one side, after which the 2 to 3 feet of high-grade gravels are shovelled up and taken to the sluice-box. In some places in the left bank of the Discovery draw the height of gravels was sufficient to admit of driving tunnels in on the bed-rock and breasting out of the gravels, but for the most part the mining-work on the Stevens lease has been open-pit work. A comparatively small yardage of gravels has been handled up to the present time. There is known to be pay-gravel at various places along the Discovery draw for a length of 1,000 feet, but it is not expected that it will all be as rich as the spot on the left bank which is known as the "Nugget patch."

Shortly after taking charge of operations Mr. Bagley erected a "puddler" near the head of the sluice-box on the Stevens lease. This machine is something like an arrastra and consists of a circular box 20 feet in diameter and 3 feet deep. The central part is solid and 8 feet in diameter, thus leaving an annular ring in which the gravel to be "puddled" is placed; water as desired can be admitted. A set of paddles is so arranged as to revolve around the annular ring, a horse walking outside supplying the motive power. After the gravel and water is sufficiently puddled by the paddles the muddy water is allowed to drain off through a discharge-pipe in the side and the puddled gravel is shovelled out and into the sluice-boxes, where it is washed in the ordinary way. Mr. Bagley believes that this puddling is necessary for a lot of the pay-gravel in order to break up the intermixed clay and properly free the included gold, so that it can be recovered in an ordinary sluice-box. The system will probably result in a higher recovery of gold from the washed gravels, but as arranged the machine necessitates considerable shovelling of the gravels by hand-work that will add somewhat to the costs.

Opening up and mining of the pay-ground on the Sheridan lease was also commenced by Mr. Bagley shortly after his arrival at the property. On this claim the pay-gravel is contained in about 3 feet of gravel lying on bed-rock and overlain by 12 to 15 feet of barren or low-grade gravels. In places the gold is found in the crevices of the bed-rock down for about a foot. The removal of all the overlying gravels by hand is not practicable, so the mining is being done by means of a shaft and drifts and breasting out from the drifts. When the property was visited in November the work was well under way, but no washing of gravels had been done. A steam plant consisting of two boilers, hoist, and pump had been erected. The hoist is used to raise the gravel by means of a bucket from the shaft and up an inclined cable to a height of 40 or 50 feet, where the bucket is automatically dumped. In this way a large dump of gravel was being formed lying directly over the head of a line of sluice-boxes. A suitable reservoir for catching and holding water had been built and the pump was being fitted up to draw water from this reservoir to the sluice-boxes. The water system is so laid out that the water after leaving the end of the sluice will gradually return to the reservoir, thus maintaining a fairly constant supply.

Very good grade gravel was being obtained from the Sheridan shaft in November; it was estimated that the 2 or 3 feet of bed-rock gravels was averaging nearly $50 a cubic yard. Good "pay" had been found for a width of at least 40 feet across the channel. Very little testing has yet been done on the Sheridan lease to prove what length of channel or pay-gravels occur; good "pay," however, is found in a shaft about 200 feet above (or farther up the draw from) the shaft from which mining of the gravels has been started.

From the statements of the receiver it would seem that the business and financial difficulties of the company are gradually being straightened out and improved. While no very great amount of testing of the company's ground has been done, it is believed that there is still a considerable yardage of pay-ground to work. It is not to be expected that all of this will be as high grade as the rich gravels in the left bank of the Discovery draw, but there is probably a lot of gravel on the two leases that will yield a substantial profit if mined by economical methods.

McGaskill & Wright. The Platt and Lynes leases were the original leases in the [illegible] staked by A. E. Platt and John Lynes. The rich ground discovered [illegible] the Discovery draw was thought to be covered by the [illegible] of Platt [illegible] surveying later it was found that, owing to faulty [illegible] was on the adjoining Stevens lease, a later location. Still later, prospecting of the [illegible] showed that there was pay-ground on it in a flat draw running more or less [illegible] Discovery draw. Owing to litigation between the owners, injunctions, and the giving of options on the property, not much actual mining was accomplished on the Platt lease in 1922. Since prospecting of the Lynes lease has been done, but no "pay" has yet been found on it. Finally these two leases were purchased outright by McGaskill & Wright.

Towards the end of 1922 testing of the Platt lease with a small crew of men was carried on under the supervision of R. N. Campbell. Part of this work consisted of sinking a shaft about 20 feet deep and drifting in the gravel on bed-rock. In the early spring of 1923 a working option or "lay" was obtained on a part of the lease by R. N. Campbell and L. D. Wright. In order to supply water for washing, a steam-boiler and pump was erected by them on the property. This water was obtained from what is called the "Big channel," a deeper but also flat draw lying to the east of the Platt draw. The water was pumped up to a line of [illegible] and the gravel as mined was hauled up by hand-hoist to the head of the sluice. This work was discontinued by Campbell and Wright in July, the results not having been as satisfactory as had been anticipated. Owing to the nature of the ground and the amount of barren gravels from 10 to 18 feet, overlying the pay-gravels the mining costs were high. For the effective working of the Platt ground a more economical method will be required. It is quite certain, however, that good values occur in the pay-gravels and that a considerable yardage has been proven. The property will therefore probably pay well when equipped with a more efficient plant.

Other Placer Leases.—Several leases on the northern side of Cedar creek were prospected during the season; this ground lies on the hillside facing Quesnel lake and across the canyon of Cedar creek from the camp proper. Ground-sluicing operations were done by W. S. Harvey and he is reported to have obtained a little gold. Some work was done by Muir, Morgan, and Weir on their leases and they planned to work all winter.

Mineral Claims.

Wonder Group. This group consists of six mineral claims and is owned by J. Creagh. The showings on the property are situated in the canyon of Cedar creek about a mile above the mouth. At this point bed-rock is well exposed in irregular bluffs forming the sides of the canyon; it is porphyritic andesite [illegible] the bed-rock exposed in the Discovery draw at the placer workings. Striking [illegible] across the canyon and exposed on the northerly side are a number of roughly parallel mineralized sheared zones. They vary in width from 1 to 8 feet and have a strike of S. 60° E. [illegible] with a fairly flat dip to the north-east. The mineralization is irregular and little or no quartz occurs as a gangue. The metallic minerals present are pyrrhotite, pyrite, arsenopyrite, galena, and [illegible] copyrite, with the first-named one in greatest abundance. Some calcite and [illegible] occur and together with altered wall rock form the gangue.

Three zones were seen and others may exist as red-stained outcrops on the [illegible] indicate areas of mineralization with iron. These three occur within a few hundred yards of one another and the lowest down the creek is the most important one. It varies from [illegible] feet in width and can be traced for a few hundred feet on the surface. It has been opened up by a crosscut tunnel and some open cuts. The tunnel has only cut one small band of [illegible] some galena, and is probably not in far enough to reach the main ore zone. Samples which were assayed are shown in the following table:

Description	[illegible]	[illegible]
Across 7 feet on upper part of main mineralized zone	[illegible]	[illegible]
Across 5 feet lower down on main mineralized zone	[illegible]	[illegible]
Selected sample from main zone, sample mineralized with arsenical iron and pyrrhotite	[illegible]	[illegible]
Grab sample from second zone	[illegible]	[illegible]
Grab sample of 3-inch stringer, third zone. Stringer is oxidized quartz and [illegible]	[illegible]	[illegible]

No assays were made for lead or copper, as it is evident from inspection that the ore would not carry appreciable percentages of these metals. The above assays should be sufficiently encouraging to the owner to carry on further development of the showings.

Other Mineral Claims.—Mineral claims were staked by K. C. Laylander covering parts of the Stevens and Platt leases, but it is not believed that any work has been done on them.

The *Eagle* and *Blue Nose* claims, situated on Cedar creek to the east of the placer camp, were examined. The showings consist of irregular impregnations of pyrite along small fracture-seams in porphyritic andesite; no definite veins occur, the mineralization being more in the nature of sheeted zones. The showings are on the banks of the creek and no work has been done to trace the zones along their strike. Representative samples were assayed, but no appreciable values of gold or silver were indicated.

The rich placer deposits of the Cedar Creek camp will undoubtedly induce prospecting in the vicinity for outcrops of lode minerals. The nature of the placer gold indicates that it had its origin somewhere in the locality; it is not meant by this that the gold is a residual deposit as has been held by some, but that it has not travelled any great distance from its source. Except where Cedar Creek has cut down into the formation, rock-outcrops are decidedly scarce, so that prospecting is considerably handicapped. The occurrence of rich placer deposits does not always indicate that lode deposits will be found in the same area, even when the gold has a local origin, but the possibility as far as the Cedar Creek camp is concerned is well worth investigation.

KEITHLEY SECTION.

The only important mining in this section is the operation of the *Kitchener* hydraulic mine, which is situated on Keithley creek 2 miles above the mouth. Some work was done by H. DeLong on his placer lease on Keithley creek and prospecting and small-scale work by individuals was carried on in a few places.

Kitchener. This property has been described in several previous annual reports. It is a well-equipped hydraulic property, with, in normal years, a good supply of water obtained by means of a 4-mile ditch and flume line from Keithley creek. An old high-level channel of Keithley creek is being worked which is about 100 feet above the present bed of the creek, so that there is an excellent dump for tailings. These advantages are somewhat offset by the character of the pit and the material which has to be piped off. The channel is deep and very steep-sided and some trouble has been experienced with slides. By piping off the top gravels and clays ahead of the main pit the slides have been largely obviated. Numerous large boulders occurring in the gravels add to the expense of operation, as many of them have to be broken up and handled before they will go through the tailings-sluice.

The season of 1923 was unsatisfactory because of a shortage of water, due to the unusually dry season. It is estimated by the manager that the season was short eighty-four "water-days" as compared with normal. The yardage handled was 564,500 cubic yards, which was nearly 100,000 yards less than in 1922, and even 1922 was a year of water-shortage as compared with normal. K. C. Laylander is the manager in charge of operations and an average crew of about twenty-five men was employed for nine months of the year.

PEACE RIVER MINING DIVISION.

INTRODUCTORY.

During the season a trip was made by the Resident Engineer into the Peace River Mining Division in order to get some first-hand information about the mineral possibilities of that part of the North-eastern Mineral Survey District. A little over a month's time was taken in going from Hazelton through the Division and back to Hazelton again, and this only gave time for a hurried run through the country. The trip was made from Summit lake, near Prince George, to Rolla Landing by boat, with side-trips on foot and horseback. The return journey from Rolla Landing was made by motor-car to Grande Prairie and thence by the Edmonton & Dunvegan Railway to Edmonton and the Canadian National Railway to Hazelton.

The water route into the Peace River District from Summit lake has been used for many years, but formerly it was necessary to commence with a boat trip up the Fraser river to Giscome and then across the Giscome portage to Summit lake. Now, however, it is simpler to go by train to Prince George and then by motor-car, some 30 miles to Summit lake. At the

lake canoes or long, flat-bottomed, river-type rowboats can be secured. The latter with an Evinrude motor attached makes a good outfit for the trip. As the supply of boats and canoes at Summit lake is somewhat limited, travellers should make arrangements ahead for what they require. Boats are made at the lake by W. H. O'Dell; address, Prince George. Freight is taken in by this route to posts on the Finlay and upper Peace rivers; flat-bottomed barges are used and the high-water period in June is the best time.

The advantage of this route into the district is that from Summit lake to the Peace river it is down-stream all the way, with no falls or rapids until Finlay Forks is reached. From Summit lake the route is by the Crooked river, McLeod lake, the Pack river and then the Parsnip river to Finlay Forks. At this point the Finlay from the north joins the Parsnip from the south, and the resulting river, the Peace, flows easterly, breaking directly through the main range of the Rocky mountains. Half a mile below Finlay Forks are the Finlay rapids, which should not be run except by skilled canoemen familiar with them. A short portage on the south bank can easily be negotiated and the boat can be lined around the edge of the rapids. Going down the Peace river the next rapids are the Parle-pas, 45 miles above the head of the Rocky Mountain canyon, and although it is possible at certain stages of the water to run these rapids, it is much better not to take the risk. A boat, loaded, can easily be lined up or down the north bank. The full name of the rapids, "Qui ne parle pas," meaning "That do not speak," is most appropriate, as coming down-stream they look insignificant and are hardly audible. The water flows with a deadly smoothness but great speed, and breaks almost silently over a hard sandstone band with a drop in the centre of about 4 feet. Signs have been erected above both the Finlay and Parle-pas rapids to warn travellers; the latter one is some distance upstream from the rapids.

The distance from Summit lake to Finlay Forks is about 150 miles and from Finlay Forks to the head of the Rocky Mountain canyon is 95 miles. The Rocky Mountain canyon, or the "Canyon of the Mountain of Rocks," or Peace River canyon, as it is variously called, is where the Peace river cuts through the foot-hills of the Rockies and emerges on to the plains. According to McLearn,* it is a recent topographic feature, the river having been forced into its present channel by a terminal moraine which closed up the old gap between Portage and Bullhead mountains, through which the river formerly flowed. The canyon is about 25 miles long and consists of a series of foaming rapids for about half the distance; below that the water is calmer, with relatively small drop and few riffles. The canyon is quite impassable for navigation. The portage around the canyon is only 11 miles in length, as the river makes a big half-circle bend. There is a wagon-road across this portage and teams and wagons can be obtained at Hudson Hope for taking supplies across.

Hudson Hope is situated at the lower end of the canyon and is the head of navigation on the Peace River. The usual type of stern-wheel, flat-bottomed river steamers are in use on this part of the river, as well as gas-boats. Hudson Hope is a small town containing two stores, one of which is a Hudson Bay post, and a restaurant. During the summer season the Hudson's Bay Company's boat makes trips to Hudson Hope from the lower Peace and a gas boat runs between Hudson Hope and Peace River (formerly called Peace River Crossing). One branch of the Edmonton & Dunvegan Railway starts from Peace River and another from Grande Prairie. The traveller from Hudson Hope can either take the boat right to Peace River and there connect with the train, or he can go to Rolla Landing, 80 miles below Hudson Hope, and there have a car meet him and take him to Grande Prairie. There is an office of the Government telegraph system at Hudson Hope, by which means a car can be ordered from Rolla, B.C. The car trip from Rolla Landing to Grande Prairie is interesting, as the route goes through the best settled portion of the district and gives a good idea of the immense area of wheat land available in this district; the towns of Rolla and Pouce Coupe are also on the route. The latter place has the Government Agency for the Peace River District.

On the water route into the district there is the Hudson's Bay Company's McLeod Lake post on McLeod lake, a post of the Northern Trading Company at Finlay Forks, and one a mile up the Finlay river from the Forks kept by W. Gibson.

Sixty miles down the Peace river from Hudson Hope is the old point of Fort St. John. This point is now practically abandoned, the present town of Fort St. John being 5 miles northerly from the old point on the river. This place was not visited on the trip.

* Summary Report, 1920, Part B, Geological Survey, Canada.

Hudson Hope is the centre for a considerable fur trade, and is also the starting-point for many big-game hunting parties. These parties as a rule go north to the Nelson River section, where grizzlies, moose, mountain-goat, and big-horn mountain-sheep are found. Guides and horses can be obtained without difficulty at Hudson Hope.

For any one looking for a pleasant canoe and camping trip this water route into the Peace River District can be highly recommended. In August and September the weather, as a rule, is perfect, the mosquito season is over, and the fishing is the equal of anywhere. Unexcelled fly-fishing is obtainable for rainbow and Dolly Varden trout and in the tributaries of the Parsnip and Peace rivers arctic trout abound. Prairie-chicken and ducks are very plentiful in the fall of the year around Rolla, Pouce Coupe, and other parts of the district.

Scenery, with which British Columbia is lavishly supplied, is also not wanting along the water trip into the Peace River Division. Going northerly from Summit lake, the rolling hilly topography of the Interior plateau gradually gives way to the massive rugged scenery of the Rockies. The low elevation of the Parsnip and Peace rivers and the abruptness with which the mountains rise from the water's edge give a magnified impression of their elevation. From Finlay Forks to about the Parle-pas rapids the Peace river cuts boldly and directly through the heart of the Rocky mountains. It is indeed remarkable, too, that in this distance going transversely through the range there are only two short and relatively insignificant rapids. Below Parle-pas rapids the mountains gradually fade away into foot-hills and the river-valley widens considerably. The Rocky Mountain canyon, where the Peace river debouches from the foot-hills on to the plains, affords magnificent scenery for the traveller; this, of course, cannot be viewed from a canoe, but from a trail along the north bank of the river. After getting through the mountains the prairie country, with its slight undulations, scanty timber, and bountiful crops of wheat, affords a striking and pleasing contrast.

Topographic and Geologic Features.

Physiographically the Peace River Division is a cut-off from the rest of the North-eastern Mineral Survey District by the Rocky mountains. The Division is triangular in shape, being bounded on the east by the Alberta boundary-line, on the south and west by the Rocky mountains, and on the north by the divide separating the waters of the Nelson River system draining into the Liard from those of the Beatton and Halfway rivers, which flow into the Peace. The main drainage of the Division is by these rivers, the waters eventually flowing into the Arctic via the Mackenzie River system. The western part of the Division embraces the Rocky mountains from the watershed easterly to the foot-hills. Easterly from the foot-hills stretches the plateau-prairie of the Great Plains, but in this latitude the plateau differs considerably from the typical prairies of Western Canada. Here the topography is more rolling and the larger rivers have cut deep valleys into the country. The valley of the Peace river is from 600 to 1,000 feet below the general level of the plateau. Except in certain areas, the country is covered with a scattering growth of small timber. Much of this is poplar, together with jack-pine, but very little of it can be considered as timber in the British Columbia sense of the word. It is, of course, useful as firewood and in certain areas some may be utilized as saw-timber. Large areas that are practically devoid of any timber are called "prairies"; examples are Pouce Coupe Prairie and Grande Prairie (the latter is in Alberta).

The Rocky mountains which form the western part of this Division are very similar in this latitude to what they are in the southern part of the Province, but do not rise to as high an average elevation. Mount Selwyn, which is a conspicuous feature, bounded by the Parsnip and Peace rivers, rises to a height of about 6,200 feet above sea-level. The Peace River pass, occupied by the Peace river—a noble and majestic stream—cuts nearly at right angles through the Rocky Mountains and is the lowest pass through the range in British Columbia.

The formations making up the Rocky mountains at this latitude are, as elsewhere, mainly of sedimentary origin. Limestones, sandstones, and shales predominate, with in places metamorphic rocks such as quartzites and argillites. No igneous rocks are known to occur. The early reports of Dawson, McConnell, and Robertson, listed in the "Bibliography," all give information about this portion of the Rocky mountains. The summary report of McLearn (1920) describes the upper Peace river where it flows through the mountains, and his 1922 summary gives detailed information about the coalfield at the Rocky Mountain canyon. A report on

this coalfield was also made by C. F. J. Galloway in 1912; with this report is included a description of the journey from Summit lake to Hudson Hope, with general information about the district.

The prairie portion of the Peace River Division is covered with the Mesozoic and Cretaceous sedimentary rocks which are found generally throughout the Great Plains of Canada. In these formations coal is known to occur, but the most important coalfield known in the Division is where these formations are uptilted to form the foot-hills of the Rocky mountains. These formations are also considered as possible sources of petroleum, but, although some investigation and drilling has been done in the Division, no commercial production of petroleum has yet been made.

ECONOMIC GEOLOGY.

The important known mineral-deposits of the Peace River Division consist of coal and placer gold. It is known that an extensive area is underlain by coal, and it is also known that the field as exposed at the Rocky Mountain canyon and on the Carbon river carries very high grade coal. Development and mining of this coalfield has of course not proceeded far owing to lack of transportation and market.

More or less small-scale placer-mining has been carried on along the Peace, Parsnip, and Finlay rivers for years, but within the last few years attempts at larger scale mining have been attempted. Owing to lack of proper methods not much success has as yet been attained, but more may be expected in the future. Associated with the placer gold in small and varying amounts is a certain amount of placer platinum.

Comparatively few lode-mineral deposits are known in this Division. The explanation for this apparently lies in the fact that throughout most of the Division the rock formations are not such as to be favourable for the occurrence of lode minerals. The great majority of lode-mineral deposits are very directly connected in their origin with intrusions of igneous rocks and in this Division igneous rocks are practically absent. Reports of copper-deposits in the northern part of the Division or in the adjoining Liard Division have been heard, but no exact information is available about them. The great distance of these deposits from transportation will in all probability prevent development of them for some time. A low-grade gold-deposit on Mount Selwyn has been known of for a long time and claims have been held on it since the nineties. Some development has been attempted, but much will be required before it can become productive. A deposit of bog-iron ore, reported to be of considerable size, lying north of Hudson Hope was examined, but was found to be of no importance either now or in the immediate future.

The possible occurrence of petroleum in the rocks of this Division has been the subject of some investigation. Geologic reconnaissances have been made by a number of oil companies and leases have been taken up. Drilling was done a few miles east of Rolla by the Imperial Oil Company and a considerable flow of natural gas was struck. Further drilling was apparently unsuccessful in finding oil as the work has all been stopped. Investigation of the country adjoining to the west the Dominion Peace River Block was started by the British Columbia Lands Department in 1919; this Department having charge of all oil and coal lands in the Province. The geologic investigation begun for the Lands Department in 1919 by J. C. Gwillim was continued in 1920 by John A. Dresser and Edmund Spieker and bulletins were issued giving their reports.

As a result of this examination it was decided to test some of the formations by diamond drilling. This was done in 1921 and holes were drilled north of Hudson Hope. The drilling showed the structure of the locality chosen to be even more favourable than it was previously known to be. It also proved the existence of oil of favourable quality—paraffin series—in the district; but it gave no producing well.

A discussion of the oil possibilities in the formations of the "Upper Peace River" is given by McLearn in his 1920 summary.

At the present time oil and coal lands in the Peace River Land District or those portions of the Peace River Land Recording Division lying within the Cassiar and Cariboo Land Districts are under reserve, so that licences cannot be acquired.

The rights to the oil and coal lands in the Peace River Block are controlled by the Dominion Government.

Coal.

The Rocky Mountain Canyon coalfield has been known for many years; leases were taken up in the area by Neil Gething as long ago as 1908. At the present time a syndicate consisting of Neil Gething, George Aylard, and R. F. Green holds forty leases, and another twenty are held by W. S. Johnston. In the immediate vicinity of the canyon no other leases have been taken up, and as the coal is under reserve none can be taken up at the present time. On the Carbon river, thirty miles above the head of the canyon, ten leases are held by C. F. W. Rochfort and partners. No other coal leases are known to be held in the Division.

A report on the field at the canyon was made for the British Columbia Mines Department in 1912 by C. F. J. Galloway; this is printed in the Annual Report for that year. In 1922 Dr. F. H. McLearn, of the Geological Survey, Canada, spent two months in making a detail examination of the field, and his report appears in the Summary Report, Part B, 1922, Geological Survey, Canada. This report is quite exhaustive, giving maps, sections of the measures, and analyses of samples from all the important seams. Roughly, the report covers the area held by the sixty leases at the canyon.

In a general way it is known that there is a large area of the foot-hills of the Rockies in this Division underlain by coal. Reports of coal-outcrops to the north of Hudson Hope on the Beatton and Halfway rivers are numerous, while to the south of the river and west of the canyon there is coal on the Carbon river. Whether these different coal areas are parts of one large field or are individual basins is not known, but it is quite safe to say that there is fair evidence of far more coal in commercial-sized seams in this Division than will be used for a long time to come. McLearn's report has a section entitled "Tonnage," in which he discusses the tonnage available from the Rocky Mountain Canyon area. With due reservations for lack of development, etc., to give any exact figures, he estimates a tonnage of 84-odd million tons from one area of 7 square miles. This includes seams of 2½ feet and over in thickness. Other areas contain similar quantities.

Very little mining or production of coal can be expected from any of the fields in the Peace River Division until such time as railway transportation is provided. It is possible that some production may be made from one seam in the Rocky Mountain Canyon field by means of water transportation on the Peace river, but even this is by no means certain; this will be discussed under the subheading "Grant Seam."

Rocky Mountain Canyon Field.—The coal in this area is found in the Bullhead Mountain formation, which, according to McLearn, belongs to the Cretaceous age. This Bullhead Mountain formation is divisible into upper and lower members, and it is in the Upper (or Gething) member that the coal is mainly found. The Lower member contains a few thin seams of coal, but, as at present known, they are not of importance.

The Gething member has a thickness of about 1,400 feet and consists of sandstone, shale, clay ironstone, and coal-seams. In this member there are between fifty and sixty coal-seams, but a great many of them are very thin seams. Quoting from McLearn: "Of the measured fifty (seams), referred to above, nineteen are 11 inches thick or less, fifteen vary from 1 foot to 1 foot 11 inches, four vary from 2 feet to 2 feet 6 inches, eleven are from 2 feet 7 inches to 4 feet, and one is over 4 feet thick; three of the eleven seams expand to more than 4 feet in at least one other section studied."

According to Mr. Gething, there are four or five seams on his property which are 4 feet or more in thickness. The writer only examined carefully one of these seams—namely, the Grant seam—which has been partially developed by the Gething syndicate. Time was not available for examining the other commercial-sized seams which are exposed on Gething, Aylard, Johnston, and other creeks. Until such time as market and transportation are in sight for this coalfield there will be but little incentive to the development of these other seams. The Grant seam has been slightly developed because of its location, with the possibility that coal might be shipped from it by water transportation down the river to Peace River. It is also a promising seam of high-grade coal and therefore a suitable one to develop as giving some indication of the possibilities of the field.

One noteworthy feature of the field is the regularity of the measures. The freedom of the strata from any serious disturbance can be well seen along the canyon, where they extend for miles with almost regular strikes and dips. Dips of from 7° to 15° largely prevail, but in a few places the short limbs of small folds have dips up to 35°. Faults are almost entirely absent

Heathcote Basin, Kamloops M.D.

Hobson Lake, Kamloops M.D.

and the gentle folding of the strata which occurs in a few places is not such as to interfere appreciably with mining operations. It may be safely said that the structural conditions of the measures are such as to make mining operations almost ideal. As a rule the overlying sandstones and shales above and beneath the coal-seams are firm and solid, so that good mining conditions would generally prevail.

As will be shown further on in this report by analyses, the coal is of high rank or grade. Most of it comes under the classification of semi-bituminous or high-carbon coal. Apart from its high-carbon content this coal is noteworthy for its low ash content, which on the average is considerably lower than any of the coals now being mined in Western Canada. The high rank of this coal, together with the low ash, makes it altogether an exceptional coal and practically the equal of the high-grade coals of West Virginia and Wales.

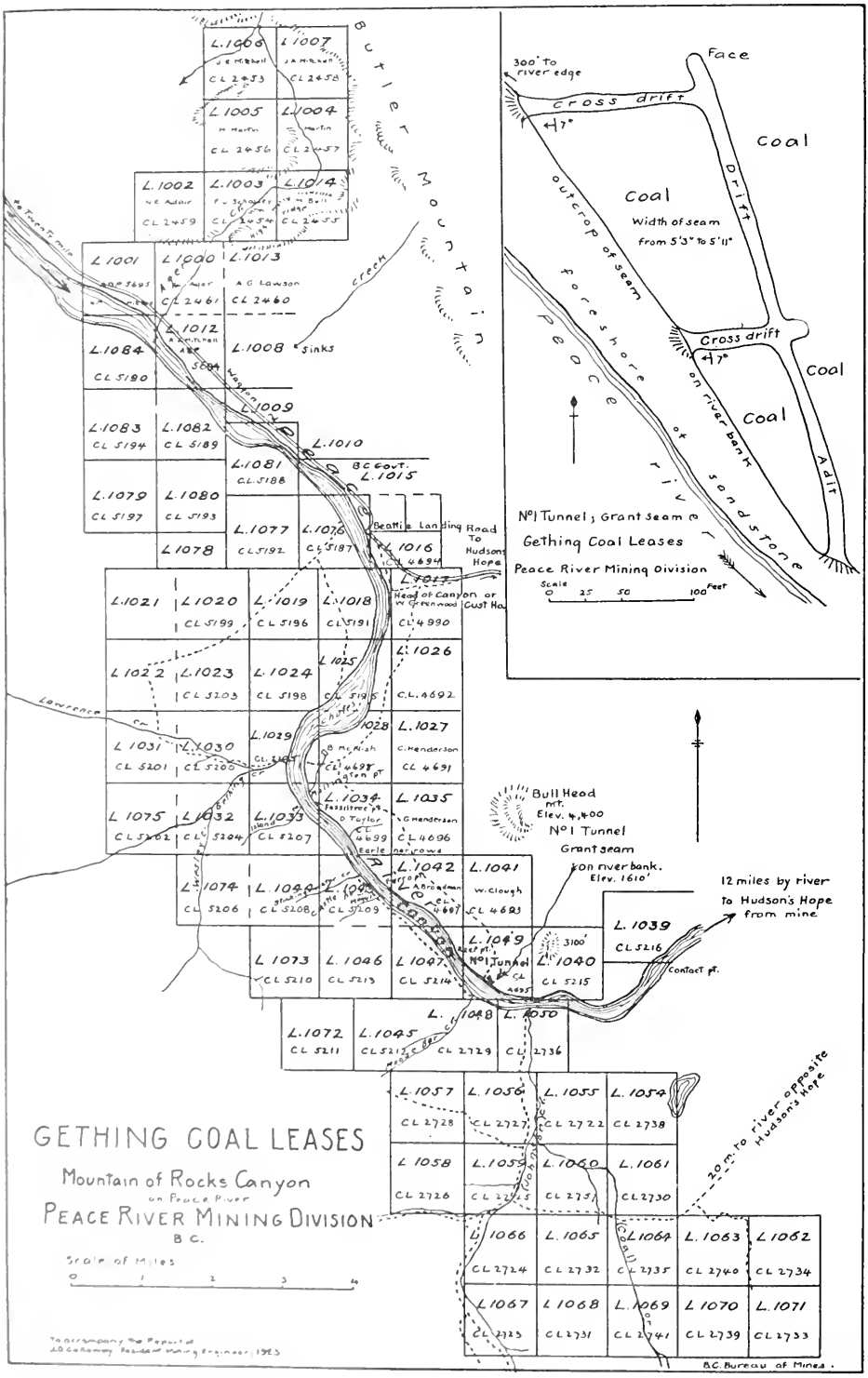
Most of the coal in this area is non-coking, although certain bands within some seams and certain small seams are fairly good coking-coal. Two more or less distinct types of coal occur in the field and in many instances a seam will contain a band of each kind of coal. The predominating type, which occurs in far the greater amount, is a hard, firm coal which is dull greyish and frequently greasy in appearance. This coal would easily stand long transportation without unduly breaking up. The analyses show it to be a high-carbon bituminous coal, with a fixed carbon content of from 70 to 80 per cent. The second type of coal is a bright-coloured, jet, friable coal, which easily and readily breaks into small fragments. It frequently occurs as a bottom bench, from 6 to 12 inches thick, of a seam containing an upper, generally thicker, bench of the dull coal. The jet coal is usually bituminous in rank and it has been found to be excellent blacksmith-coal. It has a somewhat higher ratio of volatile combustible matter to fixed carbon than the dull coal and is generally fair coking-coal. McLearn describes some of the coal in this area as cannelold coal, meaning thereby coal having the grain and fracture of cannel coal but not the chemical character.

Various estimates of tonnage of coal in the Rocky Mountain Canyon field have been made. While the lack of development in the field renders these estimates somewhat approximate, the great regularity of the measures and abundant evidence by outcrops of the continuity of the seams are factors which make these estimates seem reasonably probable. The examination of the field by the writer was not sufficiently detail to form the basis of any estimate, and in any case this question is fully covered in McLearn's report. In conclusion, it is enough to say that the tonnage and quality of coal in this field is quite satisfactory and all that is required is transportation and market.

Grant Seam.—This seam is exposed on Grant flat very close to the north bank of the river and 15 miles up-stream from Hudson Hope, or 10 miles below the head of the canyon. It crops out in a low cliff and is exposed for a distance of about 700 feet along the strike, which roughly parallels the river at this point. The seam has been developed by an adit tunnel and raises or cross-drifts. The dip is quite flat, being about 7°, so that what would ordinarily be a raise from the adit coming up the rise to the surface outcrop is not far from the horizontal. A sketch plan of the adit and outcrop of the seam is appended to this report.

As exposed this seam is very regular and consists of from 5 feet 3 inches to 5 feet 11 inches of virtually clean coal. The bottom bench of the seam consists of 9 to 11 inches of bright, friable, jet coal, which with but little handling breaks into small particles. This is an excellent grade of blacksmith-coal and some of it has been sold locally for this purpose. The rest of the seam consists of dull, greasy, grayish coal which is fairly hard and would not break up much in transportation. Some small bands and spots of jet coal occur through it. McLearn divides the upper coal into two benches, but the coal in both is practically similar and there is no parting of sandstone or shale between. The regularity and entire absence of disturbance in the coal-seam and enclosing strata is a very noticeable feature and one that has an important bearing on the economical mining of the coal. In places the seam is overlain by 6 inches of shale and above that by a band of sandstone 1 foot thick, over which there are alternating layers of shale and sandstone. In some places the coal is directly overlain by sandstone. Below the coal there is a 6-inch band of shale and below that sandstone. Both roof and floor are good for mining and but little trouble would be experienced in opening up the seam for production.

The Grant seam is only known to outcrop at the one place, along the strike it is concealed by the overlying measures and drilling or other development would be required to prove its continuity.


GETHING COAL LEASES
Mountain of Rocks Canyon
on Peace River
PEACE RIVER MINING DIVISION
B.C.
Scale of Miles
0 1 2 3 4
Butler Mountain
Peace River
Lawrence Cr.
Beattie Landing Road To Hudson's Hope
Head of Canyon or W. Greenwood Cust Ho.
Bull Head mt. Elev. 4,400
No 1 Tunnel Grant seam on river bank. Elev. 1610'
12 miles by river to Hudson's Hope from mine
Contact pt.
20 m. to river opposite Hudson's Hope
B.C. Bureau of Mines.
300' to river edge
Face
Cross drift
Coal
Drift
Width of seam from 5'3" to 5'11"
outcrop of seam
foreshore of sandstone
on river bank
Adit
No 1 Tunnel; Grant seam
Gething Coal Leases
Peace River Mining Division
Scale 0 25 50 100 Feet

The following analyses show the high quality of this coal:—

Description.	Moisture	V.C.M.	Fixed Carbon	Ash
Sample across 4 feet 6 inches at face of tunnel, excluding 11 inches blacksmith-coal on bottom	1.3	16.5	78.9	3.3
Sample across 11 inches blacksmith-coal	2.2	23.0	71.5	3.3
Sample across 5 feet 5 inches near face of tunnel, full width of seam	1.1	18.5	75.5	4.9
Sample by McLearn, cliff 300 feet west of west crosscut, middle and top 5 feet	0.8	20.4	75.4	3.4

In McLearn's report the results of thirteen analyses of samples from this seam are given and they show the uniformly high grade of this coal. Six of his samples which were tested show the calorific value of the coal to vary from 14,420 to 15,130 B.T.U. The bottom 11 inches of coal in this seam is coking-coal, but the rest is non-coking. McLearn classifies the blacksmith-coal in the bottom bench of this seam as ranging from bituminous to semi-bituminous in rank, while the upper coal is all semi-bituminous. The word "semi-bituminous" is used to mean a coal lying in rank between bituminous and anthracite. By applying Dowling's "Split Volatile Ratio" to the analyses the blacksmith-coal of the bottom bench would be ranked as just barely above bituminous coal and all the upper coal as high-carbon bituminous.

From the analyses it will be seen that this coal would be just about ideal fuel for nearly all purposes. It burns readily and is nearly smokeless, with a high heat. It has been used at Hudson Hope as domestic coal and gives entire satisfaction, and it is evident that it will prove very satisfactory as steam-coal. The low ash content is particularly noticeable. As would be expected from the analyses, the thermal value is high, being the equal of the high grade coals of the world.

In order to get a practical test of the suitability of this coal for use in steam-boilers a shipment of 40 tons was taken down the river by scow in September of 1923 to Peace River. This shipment was turned over to the Edmonton & Dunvegan Railway Company with the understanding that suitable tests would be made with it in locomotive boilers. This coal had been taken down the river on sleighs in the winter-time from the mine to Hudson Hope. The scow was built there and, after loading, taken down-stream to Peace River. No information has been received as to the results of this testing.

The situation of this seam is such that it may be possible to mine and ship coal from it by water transportation without waiting for railway transportation into the district. It is believed by Mr. Gething that scows could be taken by river-boats almost up to the mine, as although it is in the canyon there is but little fast water between the mine and Hudson Hope. A survey shows that the drop in this 15 miles of the canyon is only 80 feet, which is not sufficient to give an excessive current on the average. Below Hudson Hope the navigation of the Peace River presents no difficulties and river-boats have been running for some years. The town of Peace River is 255 miles below Hudson Hope and it is to this place that the coal would have to be taken. The possible market would be to the Edmonton & Dunvegan Railway and the towns served by this railway. At the present time it is stated that the railway company, which is operated under lease by the Canadian Pacific Railway, is bringing coal for its own use from the Crowsnest pass. If this is correct, then the cost of water transportation for the Gething coal probably would not exceed the rail haul on the present supply. And the high quality of the Gething coal should ensure it a ready market. Transportation by water down the Peace river would only be possible for about half the year, which would be a disadvantage in obtaining a continuous supply, as storage would have to be provided.

Riverside Seam.—This seam lies 35 feet below the Grant seam. It is exposed at low water on the north bank of the river just below the adit tunnel on the Grant seam. Where it crops this seam is 2 feet 10 inches thick, with a thin bottom bench of friable jet coal and an upper bench of dark-grey coal. An analysis of this coal by McLearn shows that it is similar in quality to that of the Grant seam. No development of the seam has been done. It is hardly thick enough for commercial mining, at least for some time to come.

Milligan Seam.—This seam is exposed on Milligan point, on the north bank of the river, about 5 miles down-stream from the head of the canyon. As exposed the seam is 2 feet 10 inches

thick. A sample across this width had the following analysis: Moisture, 4.6; V.C.M., 18.5; fixed carbon, 72.3; ash, 4.6. The seam is exposed at other places but was only examined at the one place. McLearn states that it is exposed at different points over a distance of about 4 miles and to vary in thickness from 2 feet 5 inches to 2 feet 10 inches. This seam is also somewhat too thin for commercial mining.

No other seams were examined by the writer, but in his report McLearn gives detail descriptions of fifteen seams in all. Some of these were identified as outcropping at different points over several miles. The more important of those that were not seen are: The Trojan seam, varying from 3 feet 7 inches to 8 feet 4 inches thick; the Titan seam, from 4 to 5 feet thick; the Mogul seam, from 3 feet 2 inches to 4 feet 8 inches thick; Galloway seam, 4 feet thick; and a seam on Johnson creek, 4 feet 1 inch thick. Analyses of samples from these other seams show the quality of the coal similar to that of the Grant seam—namely, bituminous to high-carbon bituminous coal and with the average ash content quite low. Development consisting of short tunnels has been done on some of these seams.

Carbon River Field.

The Carbon river is a tributary of the Peace river coming in from the south at a point about 30 miles above the head of the Rocky Mountain canyon. A two-day trip was made by the writer to examine a number of coal-outcroppings along this river and its tributaries. From this rapid inspection it was apparent that a considerable area at this point is underlain by coal formation. The general appearance of the sandstones, shales, and coal-seams that make up the formation is similar to that of the Rocky Mountain Canyon field, and it will probably be found that they are contemporaneous in origin. Whether or not these two fields are continuous and connected is not known, as they are 25 to 30 miles apart.

Coal leases were staked in this field many years ago and only some of them have been kept in good standing. Ten leases are now held by C. F. W. Rochfort and partners, but it is not known that any others are held. These ten leases have been surveyed, but practically no development has been done on any of them.

The coal in this area is exposed near the Carbon river and along the tributaries named 5-Mile, 7-Mile, 9-Mile, and 11-Mile creeks. All these creeks flow in from the west side and the mileage indicated by the names is approximately the distance of each from the mouth of the Carbon river. Time was not available to find all the outcroppings of coal that are said to occur, but enough were seen to give a fair idea of the character of the coal-seams in this field. The writer was efficiently guided to the showings by C. G. Jones, who has a ranch on the flat formed by the confluence of the Carbon river with the Peace river.

Eleven-mile Coal.—These showings are from ¾ to 1 mile up 11-Mile creek from the Carbon river. Several seams are exposed in a small bluff which has been formed by the creek cutting down into the measures. The most promising one is near the top of the bluff and has a width of 5 feet of practically clean coal. Twenty-five feet below this there is another seam with a band of sandstone in the centre, the section of which is: Coal, 16 inches; sandstone, 3½ feet; coal, 25 inches. Below this there is another smaller seam. These seams outcrop on the west bank of the creek at an elevation of 2,600 feet. Exposures of coal are also said to occur on the eastern side and some distance from the creek, but these were not seen. According to Mr. Jones, at this place the seams stand vertically and the formation is badly broken.

Where examined on 11-Mile creek the formation is nearly all sandstone, with only narrow bands of shale above and below the coal. The general strike of the measures and seams is east and west (mag.), with a southerly dip of 20°. The measures, as far as exposed, are regular, without any distortion.

Analyses of samples of this coal will be found in the table giving all results following the descriptions of the seams.

Nine-mile Coal.—This coal occurs 2 miles up 9-Mile creek from the Carbon river at an elevation of 3,360 feet. The seam is exposed almost in the bed of the creek and nearly covered with clay and gravel. It consists of a bottom bench of coal 10 inches thick and a top bench 4½ feet thick, separated by a 2-inch parting of shale. On account of its situation this coal-outcrop is badly crumbled and weathered and dirty with infiltrated clay. The seam was picked into for a short distance in order to get a fairly clean sample for analysis, but the permeation of surface clay along the seams was found to be persistent, so that a proper clean sample could

not be obtained. Considering this, the result of the analysis showing only 3.2 ash shows that the coal is really very free from ash. No development has been done and the seam is only exposed at the one place. Other seams, apparently small ones, are visible in the cliffs along the creek, but they were not examined.

Seven-mile Coal.—This coal is exposed on the east bank of the Carbon river half a mile below the mouth of 7-Mile creek. It was at one time staked by C. G. Jones, but is now vacant, and automatically therefore under reserve.

This is a nice-looking seam 4½ feet thick, with a solid sandstone roof and a shale floor. The only development consists of a large surface cut. The seam has a strike of N. 20° E. and dips at 12° to the south-east. At the place opened up there is a 5-inch band of bony coal in the centre of the seam, which, however, is not continuous along the strike of the seam. Thirty feet above this seam there is another one 30 inches thick and higher up a smaller one.

Other small seams of coal occur near 5-Mile creek and at other places, but they were not examined closely nor sampled.

The following table gives the results of analyses of samples from this field:

Description.	Moisture	V.C.M.	Fixed Carbon.	Ash.
11-Mile, 5 foot seam, across full width	4.6	25.2	65.6	3.6
11-Mile, across 16 inches of lower seam, top bench	2.9	25.7	56.2	17.2
11-Mile, across 25 inches of lower seam, bottom bench	3.4	26.2	67.7	2.7
9-Mile, across 64 inches, full width of seam, excluding 2 inches of shale parting	5.5	24.8	61.5	8.2
7-Mile, across 4½ feet, full width of seam, but excluding 5 inches bone	2.1	22.0	68.4	6.5

All the above samples are reported by laboratory test to be non-coking coal. The rank of the coal is bituminous. As shown by the above analyses, this is a first-class quality of coal, with a low ash content in all but one sample. As all samples were average samples taken from more or less weathered outcrops, it is probable that on development the seams would be found to contain coal with a still lower ash content.

The coal in the Carbon River field is very similar to that of the Rocky Mountain Canyon area. Both the dull-greyish coal and the jet coal occur, and much cannel coal is found as float along the bars of the river. The analyses of the samples from this field show as compared with the Canyon field a slightly lower percentage of fixed carbon and correspondingly higher percentage of volatile combustible matter.

At the present time there is a rough trapper's trail up the Carbon river, and with the exception of the 9-Mile seams the showings are only a short distance from the main trail. But little will ever be done with this field until such time as there is a railway into the district. The transportation of the coal down to the Peace river or to where a railway was constructed would present no difficulties.

PLACER MINING

Varying amounts of placer gold are found in the gravels of the Parsnip, Finlay, and Peace rivers and their tributaries. Some placer platinum occurs with the gold, but as a rule the amount is very considerably less than the gold and in many places it is practically negligible. The gold occurring in these gravels is always fine and some of it may be classified as "flour" gold. It is quite evident that this fine gold has not had a local source, but has come long distances from the headwaters of the rivers. The deposits in which this gold in appreciable quantity is found are typical bar concentrations; in some cases these bars are the present ones in the streams, while in others they are old bars forming flats and low terraces along the valleys. The gold has been transported by glacial action and also by normal fluviatile action in both Pleistocene and Recent time. In the working over of the clays, sands and gravels in the stream-valleys the gold becomes concentrated at suitable places and a deposit is formed which is relatively much richer in gold than the bulk of the material. This action is going on continually, so that new auriferous bars are being formed in the rivers. In deposits of this nature only the upper parts are enriched and as a rule there is little or no concentration of gold on bed-rock.

Small-scale mining of bars and flats along these rivers has been carried on for years. In this work rockers are used and in some places a small creek supplies water for ground-sluicing and washing. In a few instances power-pumps have been used to supply water from the river for the sluice and the gravel mined by hand. As the gold is fine and flaky, care has to be taken in saving it, for much of it has a tendency to float and is thereby lost. The yearly production of gold from this hand-mining is, however, small, and as a rule no record of it is obtainable.

It has been considered by many that some of the gravel flats along the Peace river would pay to work by large scale methods, such as dredging of some type. Two such attempts have been made and these will now be described.

Peace River Gold Dredging Co.—The site of this company's operations is at Branham flat, 26 miles above the head of the Rocky Mountain canyon. The flat is a large one, the distance from the edge of the river back to the hill bounding the valley being about 2 miles and with a corresponding length up and down the river. The company acquired a number of placer-leases on the flat which had been taken up by individuals a few years ago. In 1921 a ground-sluicing plant was operated on the gravels close to the river by Woods & Taylor. In 1922 a drag-line excavator was erected by this company and some gravel was mined. Mechanically the plant did not give satisfaction and metallurgically some difficulty was found in saving the fine gold. Improvements to the plant were made in 1923 and a clam-shell bucket was tried, but still no great success was attained. During the latter part of the season of 1923 the company confined its work to testing the gravels at a number of places over the flat by means of shallow shafts. Different managers have been employed by the company, but at the time the property was visited in August, 1923, W. W. Paterson was in charge of the testing-work. E. Nehring, one of the directors of the company was on the ground and handled the business end of the company. Mr. Paterson's work was to figure out the best way to save the gold and platinum in the gravels and at the same time to make a comprehensive series of tests to find out the average values contained in the gravels. It is stated by the company's officials that the testing-work was satisfactory in every way and that much work will be carried out in 1924. The present excavating plant will be remodelled or a new one taken in and actual mining of the gravels will be commenced.

The mining operations of this company have been on the side of the flat where it is bounded by the river, the pit that was excavated being only a short distance from the water. The deposit consists of sand and gravel, with very little clay in it. As a rule there is about 6 feet of sand on the surface and this is underlain by gravel. Large boulders are almost entirely absent, and, as there is no sign of the gravel being cemented it should be ideal material for dredging or excavating. No attempt has been made to get down to bed-rock, and it is more than probable that there is at this point a very considerable thickness of gravels and clays lying on bed-rock. The fine gold and platinum is contained in the gravel, and it is believed by Mr. Paterson, metallurgist for the company, that the bulk of the values is contained in the first 25 feet from the surface down. No testing has been carried below this depth.

The important question with regard to the property is what the average values are, and this can only be determined by extensive testing. No information is available as to the actual gold recovered from the pit that has been worked, but in any case it is claimed that the gold-saving appliances of the plant were not satisfactory, so that the results might not be conclusive. It is stated by the company officials that there is a large yardage of gravels on the flat which will run about 50 cents a cubic yard. If this is correct, then this property should make a nice dredging proposition. Most of the gravel on the flat to a depth of 25 feet is above the average water-mark of the river. Even extreme high water is considerably lower than the surface of the flat.

The plant erected by the company is the ordinary type of drag-line excavator, in which a digging-bucket or scraper is loaded by being pulled against the face of gravel in the pit. The power is supplied by a steam boiler and engine and the scraper is moved backwards and forwards by means of travelling-cables and blocks attached to derricks. After being loaded the scraper is elevated up to a bin, where it automatically unloads. The gravel from the bin is run out into sluice-boxes with a stream of water and the gold saved in the sluices and special gold-saving machines which treat the fines from the boxes. The power for the whole plant is supplied by two steam-boilers burning cordwood as fuel. A 25-horse-power engine runs the drag-line operat-

ing the scraper; a 27-horse-power engine runs the pump and an amalgamator. The pump is capable of supplying 1,000 gallons a minute for sluicing purposes.

The plant was not seen in operation, so it was not quite evident what the mechanical defects in it were. The scraper or bucket which had been used was not a good design for the use intended and apparently did not dig satisfactorily. For effective work more power is required. For drag-line excavation, even when the material handled is suitable, abundance of power and very strong tackle is required. The attempt to dig the gravel with the use of a clam-shell bucket which was made in the early part of the season of 1923 was, as might have been expected, unsuccessful. Owing to pebbles and small boulders in the gravel the teeth of the bucket would not close sufficiently to retain the load of sand and gravel while it was being hoisted to the top. In 1922 two large boilers were bought by the company with the intention of taking them into the property. These weighed about 14 tons each and were rated at 125 horse-power. They were shipped to Hudson Hope by river-steamer from Peace River, the terminal point of the railway from Edmonton. One of the boilers was taken half-way across the portage from Hudson Hope to the head of the canyon and left there. The other one is stored at Hudson Hope. From the end of the portage the boilers could be taken up to Branham flat on a scow. One of them at least will probably be taken into the property in 1924. The company has a small sawmill 2 miles down the river and on the opposite side from the property. Camp buildings, etc., have been erected at the plant. During the season of 1923 eight to ten men were employed.

Dredge at Fort St. John.—The company erected and operated in 1922 a dredge on the Peace river near the site of old Fort St. John. Very little is known about the operations of the company, as none of the officials were seen by the writer. It has been said that the work done in 1922 was not particularly successful. The dredge is now ashore on the river bank almost opposite the old Hudson Bay post at Fort St. John. Apparently a number of places on the banks and bed of the river were dredged. During part of the season of 1923 the company had a crew of men engaged in testing various bars and flats along the river a few miles up stream from or west of Fort St. John. This testing was being done when the writer was in the district but unfortunately the party was missed.

The dredge is the single-bucket type, practically like a steam shovel mounted on a pontoon. Power to run the dredge was supplied by a steam boiler; all machinery being carried on the pontoon. After being delivered by the bucket to the pontoon, the gravel was washed in sluice boxes and the fine material treated in amalgamators. When seen the dredge was in a somewhat dilapidated condition, but there is no evident reason why it would not satisfactorily dig the loose gravels along the river, although more power might have been desirable. Possibly the gold-saving end of the dredge did not function properly.

It is apparent that only certain limited areas of the gravels along the Peace river will possibly pay to work by dredging methods, and so careful and thorough testing should precede any dredging enterprises in order that failures will be avoided.

MOUNT SELWYN.

Mount Selwyn is one of the outstanding prominent features of the Rocky mountains in this Division. It occupies a considerable area lying between the Parsnip and Peace rivers. The elevation, 6,220 feet, is not great, but rising abruptly from the Peace river it has the appearance of quite a high mountain.

Most of the mountain consists of quartzite and schist, with some limestone. No igneous rocks are known to occur. The predominating feature of the mountain is the broad band of quartzite which stands out prominently on the lower slopes. Mineral claims were staked on the mountain many years ago and most of these cover areas of the quartzite formation. Low gold values are said to occur throughout the quartzite formation, which is frequently called quartz.

Occurring throughout this quartzite there is a certain amount of quartz which occurs in small stringers and veinlets. No quartz veins were seen in it which were regular and well defined or continuous for even a few hundred feet. The various stringers of quartz do not look like a series of parallel veins or fractures, but strike and dip in all directions. The total amount of true quartz in the formation forms almost a negligible percentage of the whole mass of quartzite. Practically no metallic minerals occur either in the quartzite or the quartz, the only exception being an occasional grain of pyrite. It is claimed that the gold values occur

generally throughout the quartzite formation without relation to the quartz. The gold is said to be "free," which might be expected, as there are no appreciable metallic minerals, such as sulphides, to contain it. In examining this occurrence of "gold quartz" there are no particular showings to be seen; the whole face of the mountain is quartzite and one part is as good or as well mineralized as another. Average values of from $2 to $4 a ton are claimed for various parts of the quartzite formation. No sampling was done by the writer, as it was obvious that to get any results worth while a month or two would have to be spent in sampling. The only question to be determined is the one of average values in the whole or appreciable parts of the quartzite formation, as there is literally millions of tons of the rock "in sight."

Peace River Mining and Milling Co.—In 1899 a number of claims were staked on Mount Selwyn by Joe Coffee; these claims, with others staked afterwards, are the nine Crown-granted mineral claims owned by the Peace River Mining and Milling Company. The company is incorporated in British Columbia but has its head office in St. Thomas, Ontario. Most of the capital of the company has been subscribed in Ontario. Intermittent operations have been carried on at the property by the company. Development to expose and open up the quartzite formation was unnecessary and therefore but little has been done. The company has, however, extensively sampled the quartzite, and to get these samples numerous shallow cuts and pits have been made. It is claimed that the samples taken from the property at different times total up to about 2,000. The prospectus issued by the company contains a list of thirty assays of samples from the property; these show gold values varying all the way from a trace to $46 a ton. If the sampling has been properly done it is apparent that the company should have sufficient information to determine approximately the average value of the surface rock at least. The company's prospectus also says: "A mill-run of 30 lb. of ore made by the Ogden Assay Company gave returns of $2.40 to the ton in gold."

In the summer of 1922 a Ross mill was taken into the property, with which it was intended to mill some of the rock. This Ross mill, together with a small crusher, was erected at a site on Quartz creek about half a mile from the river. Power to run the mill was supplied by a water-wheel. The outfit did not give satisfaction, apparently owing to insufficient power, and nothing was accomplished. In 1923 a 10-horse-power boiler, a 7-horse-power engine, and a pump were taken into the property. The new machinery, together with the Ross mill and the crusher, was erected at the old landing right at the edge of the river. With the boiler, plenty of power was available for running the mill and pump. A timber chute or slide was built extending up the mountain from the plant to the nearest outcrop of quartzite, a distance of about 1,700 feet on a steep ascent. Sacks of the rock tied in rawhides were slid down the chute to the mill and there treated. The mining and transportation of the rock was comparatively simple and the system worked well. Unfortunately no success was attained with the Ross mill. About 12 tons of rock was put through the plant, by which time both the crusher and the mill were so badly worn as to be useless without repair parts, which were not available. It was also found that practically all the mercury or amalgam went out of the mill down the tailings-sluice into the river. No appreciable gold or amalgam was saved from the milling of the 12 tons; so the season's work was disappointing.

The reason for attempting to mill some of the rock in this way in a small scale was the popular one of getting a "mill test," as it is obvious that milling $2 to $4 rock in this way could not be done to yield a profit. It is, however, doubtful if mill tests of this kind yield any results as to average values in the rock which are any more definite than could be obtained by careful sampling and assaying. And the expense involved in taking in machinery, etc., would be sufficient to do very extensive sampling.

If it is first conclusively demonstrated that the surface rock exposed on the side of the mountain carries from $2 to $4 a ton in gold values the next step should probably be to ascertain average values at depth, preferably by diamond-drilling. If the quartzite formation as a whole carries average values such as these the possibilities for the property are that by mining and milling on a large scale a profitable low-grade mine would be made. Attempts at mining a few tons a day cannot be considered as other than an expensive form of sampling and assaying. Granted that the values are as claimed, the equipping of this property for mining and milling on the scale that would be necessary would involve a heavy capital investment.

The work at the property during the season of 1923 was managed by David Barr, who is president of the company. R. D. Featherstonhaugh was also at the property, assisting in running

Clinton, Magnesite Deposit at Clinton M.D.

Clinton, Sodium-carbonate Deposit, Clinton M.D.

the mill. Work was stopped about the end of August. The future plans of the company are not definitely known; but it is believed that further work will be carried on in 1924.

Although this property is situated a long way from a railway, it is by no means inaccessible. The water route from Summit lake is quite good enough for the bringing in of heavy machinery if the barges are brought down in the high-water period. With a relatively slight amount of improvement of the route along the Crooked river, boats carrying necessary supplies could run all the open-water season. The rivers are of course closed for navigation by ice for about half the year. It is also quite possible to bring in equipment from Peace River via Hudson Hope and the portage, and then up the river to the mine. Freighting costs would possibly be slightly higher by this route. In 1923 the boiler and engine for the property was taken in without difficulty by the Summit Lake route. The transportation of the final product of mining operations at this point would present no difficulties, as it would be neither ore nor concentrates, but gold bricks. Some water-powers are available not far from the property and there is excellent coal in the district.

IRON-ORE SHOWINGS NORTH OF HUDSON HOPE

It had been reported to the Department that there were some very large deposits of hæmatite or limonite iron ore to the north of Hudson Hope. While it was realized that iron ore in the Peace River Division could only have a potential value until such time as transportation and market were available, which might not be for some years, still the reports about these iron-showings were such that it was considered advisable to get some exact information about them. A seven-day trip was therefore made by the writer with saddle and pack horses to see some of the showings which are closest to Hudson Hope. Wm. Carter, one of the owners of claims covering the showings, was the guide for the trip. Many claims have been staked in the area by Carter, Innes, and others, but very little development work has been done.

The showings were found to consist of spring deposits of bog iron ore and to be small in size and very scattered in their nature. In many places they only consist of impregnations of iron oxide staining the surface gravels and clays. All the deposits were not seen, but enough were examined to give a fair idea of the whole occurrence. Unfortunately the conclusion is that these deposits are of no commercial value as a source of iron ore, either at the present time or at any reasonably future time. The reasons for this conclusion are given in the following detail description of the showings.

These deposits of iron ore are situated on Cameron river (the North fork of the Halfway river) and are found at intervals along the valley of this stream all the way from its head down to where it joins the Halfway river, a distance of 30 to 40 miles. A number of the outcrops were examined at a point about 10 miles up Cameron river from its mouth. The deposits are not continuous, but consist of isolated, small, circular masses of bog iron which is relatively pure near the centre, but grades off into iron stained gravels and clays on the outside. Each deposit has had its origin from a central spring, the water of which contained iron in solution, which was precipitated as iron oxide after reaching the surface. In many instances the springs forming the deposits have ceased to flow, and the bog iron loses some water and begins to harden into what has the appearance of soft decomposed rock. One spring actively flowing was seen, and here the precipitated iron oxide has formed a little basin out of which the water bubbles. Around the sides of the basin the iron ore is a soft, oozy, yellow mass, while farther away it gradually hardens into rock which has a dark red to almost blackish colour. From the nature of the origin it follows that this iron ore is mixed with all the surface material around the spring, such as clay, gravel, soil, and pieces of wood. The actual amount of iron deposited from such a spring is small and a long time would be required to produce a large deposit of the ore. Generally before this happens the spring has ceased flowing, the water having been diverted to a new outlet. The pure iron oxide deposited near the mouth of the spring is good grade ore, but where it is mixed with the surface materials it is too low in iron content to be of possible value as iron ore. In any of the showings seen it would be impossible to get more than a few hundred tons of clean iron ore.

One mile to the north-west of the flowing spring a series of small deposits were examined on which some development-work has been done. The springs which had formed this series of outcrops of iron ore have stopped flowing and the deposits are hardened into fairly dense ore. One shaft 6 feet deep has the following section going downwards: 2 feet of surface soil, 3 feet of impure iron ore, and 1 foot of yellow clay. Another shaft shows 7 feet of clay and gravel

stained with iron oxide, and below that 2 feet of very low-grade iron ore. At various places on the surface over an area of about 1,000 by 500 feet small outcrops of iron ore and iron-stained clay occur. It is quite apparent from the surface-stripping, open-cuts, and shallow shafts that nowhere is the iron ore continuous for any appreciable distance, and also that most of it is too much mixed with clay and gravel to be of any value as iron ore; average assays of the material show too low an iron content for it to be classed as iron ore.

The following table shows the results of assays of a number of samples taken from these iron-deposits:—

Description.	Iron. Per Cent.
Sample across 2 feet in shaft	31.8
Sample of best ore on dump from shaft	42.5
Sample across 3 feet in second shaft	28.6
Sample of yellow clay at bottom of second shaft	24.4
Sample of hard, clean, black ore from near flowing iron spring	57.2
Sample of soft wet ore as deposited by spring	50.8

No analyses were made for sulphur and phosphorus, but according to analyses made by the owners these elements are not present in appreciable quantities. Inasmuch as any material containing less than 50 per cent. iron cannot be considered as possible iron ore, it is apparent that there is but little material in these deposits which would be classed as such.

Throughout the sedimentary formations of this district there is a certain amount of iron occurring as clay ironstone. The Bullhead Mountain formation contains many narrow lenticular bands and concretions of this material. It is probable that the iron in the spring waters is derived by leaching processes from this clay ironstone. After gathering a load of iron in solution the waters travel underground for some distance and finally reappear at the surface as springs, and give up their iron content on contact with surface oxidizing conditions. Such "iron springs" are numerous throughout the district and many such can be seen along the banks of the Peace river below Hudson Hope, where their presence is indicated by red rusty patches staining the ordinarily grey and blackish sandstones and shales. The Halfway River section is in the low foot-hills of the Rockies, and here springs are very numerous, as some of the water from the higher elevations first sinks and then flows underground for a distance until finding a suitable outlet by which to come to the surface.

The deposits that were examined are about 40 miles due north of Hudson Hope in an air-line, but by trail nearly 60 miles. The trail, which is not a particularly good one, much of the distance being over wet swampy ground, crosses the South fork of the Halfway river not far from the Diamond G Ranch. At this point the South fork flows in a wide terraced valley which is nearly all open land, the only timber consisting of a few scattered willows and poplars. Large flats containing thousands of acres are almost clear land and the growth of wild grasses, including peavine, is tremendous. Rising from the wide valley are low hills which for the most part are covered with grasses and but little timber. It is noticeable in all the river-valleys of this district that the hills on the northern sides of the valleys are very free from timber, while those on the southern sides are frequently covered with a fairly dense growth of small poplar and jack-pine.

The Diamond G Ranch was started a few years ago as a cattle-ranch, but is somewhat handicapped by its distance from suitable transportation and market. The trail from Hudson Hope has been cut out so that it is a rough sleigh-road in winter-time, and farming machinery has been taken in this way. About 100 acres is cropped in grains and hay and from 100 to 150 head of stock are kept on the ranch. All told, the owning company has 11,000 acres under lease and there is the possibility of making a very large cattle-ranch out of the property. The winters are cold, but the snowfall is light, and in some years very little hay has to be fed to the cattle.

CARIBOO DISTRICT.

CARIBOO MINING DIVISION.

REPORT BY H. REECH, GOLD COMMISSIONER, BARKERVILLE.

I have the honour to submit the office statistics of the Cariboo Mining Division for the year ended December 31st, 1923.

Free miners' certificates issued	151
Mineral claims recorded	85
Placer claims recorded	27
Placer claims rerecorded	24
Placer-mining leases issued	46
Certificates of work (mineral)	119
Certificates of work (leases)	127
Powers of attorney recorded	48
Leases	37
Mineral claims	221

Revenue.

Mining receipts	$16,383 13
Free miners' certificates	1,354 00
Water rentals	1,200 00
Other sources	334 25
Total	$20,072 38

OMINECA MINING DIVISION.

REPORT BY S. H. HOSKINS, GOLD COMMISSIONER, SMITHERS.

I have the honour to submit the office statistics of the Omineca and Peace River Mining Divisions for the year ended December 31st, 1923.

Free miners' certificates (ordinary)	691
Free miners' certificates (company)	7
Free miners' certificates (special)	3
Mineral claims recorded	641
Certificates of work recorded	925
Placer claims recorded	16
Bills of sale and mining agreements recorded	243
Powers of attorney recorded	21
Mining documents filed	59
Certificates of improvements recorded and issued	8
Applications for placer-mining leases (Omineca Division)	24
Placer leases issued (Omineca Division)	22
Applications for placer-mining leases (Peace River Division)	14
Placer-mining leases (Peace River Division)	3

Revenue.

Free miners' certificates	$ 3,815 20
Mining receipts	8,417 40
Total	$12,232 60

QUESNEL MINING DIVISION.

REPORT BY H. B. CAMPBELL, GOLD COMMISSIONER, WILLIAMS LAKE.

I have the honour to submit the office statistics of the Quesnel Mining Division for the year ended December 31st, 1923.

Free miners' certificates issued (individual)	507
Free miners' certificates issued (special)	7
Mineral claims recorded	56
Certificates of work issued ("Mineral Act")	30
Placer claims recorded and rerecorded	17
Leaves of absence	4
Applications for placer-mining leases	124
Placer-mining leases issued	78
Placer-mining leases in force	213
Certificates of work issued ("Placer-mining Act")	95
Powers of attorney recorded	97
Conveyances and agreements recorded	75

Revenue.

Free miners' certificates	$ 2,426 50
Mining receipts, general	9,288 50
Total	$11,714 00

CENTRAL MINERAL SURVEY DISTRICT (No. 3)

REPORT FOR YEAR 1923.

BY A. W. DAVIS, RESIDENT MINING ENGINEER.

INTRODUCTORY.

The No. 3 or Central Mineral Survey District comprises the seven Mining Divisions of Clinton, Lillooet, Kamloops, Ashcroft, Nicola, Vernon, and Yale. The Resident Engineer's headquarters office is at Kamloops, from which point most parts of the district can be reached by a few hours' journey by rail or by motor over good roads.

Mining operations in Mineral District No. 3 have been accompanied in 1923 by rather encouraging results. As regards shipping-mines, the *Iron Mask* mine near Kamloops, milling about 300 tons a day of copper ore, constitutes the only actual producer on anything like an extensive scale. Encouraging results from development have been obtained elsewhere, notably at the *Windpass* mine at Chu Chua, on the Canadian National Railway, about 20 miles north of Kamloops. On this property high-grade gold ore has been opened up in such quantity that the erection of a long aerial tramway and a mill is being seriously considered by the owners, who are experienced mining men.

North of Kamloops, at the headwaters of the Clearwater river, is a new area which may develop into a producing goldfield. This district was visited by the writer during the season and a favourable impression obtained as to its possibilities, although nothing but raw prospects exist there as yet. The claims, in fact, were only located during the war and the field is practically a virgin one.

It is hoped that some day Highland valley, south of Ashcroft, may produce copper on a fairly big scale, but with copper prices as low as they are and a number of large producers active in the States, the time for this is not yet.

The deposits of magnesium sulphate (Epsom salts), sodium sulphate, and carbonate of soda occurring in this district may gradually become a source of revenue. One property near Clinton (the Lillooet Soda Company) has just installed a small plant for making soda-ash and is steadily increasing its scale of operations. The shipping point is Chasm, on the Pacific Great Eastern Railway.

Lying inactive at Falkland, between Kamloops and Vernon, on the graded line of the Canadian National Railway, are the gypsum deposits. With this railway in operation a permanent industry may be inaugurated.

The district has received during the year the attention of a number of mining engineers and others interested in securing suitable properties.

KAMLOOPS MINING DIVISION.

KAMLOOPS AREA.

Near Kamloops the *Iron Mask* mine has been a steady producer of copper concentrates throughout the year, which have been shipped to Trail to be smelted. This property was referred to in the 1922 Report. It is developed by an inclined shaft 700 feet deep. On the Iron vein, to the east of the main workings, a considerable amount of copper-carbonate ore has been left unmined. This cannot be treated by flotation process as in the present mill and may probably have to be leached. The management is at present doing some experimenting in connection with a process, although the tonnage of this material cannot be very large. In the main vein of the *Iron Mask* the ore now being mined occurs as chalcopyrite mixed with pyrites. The country rock is gabbro, which, along certain zones of fissuring, has been mineralized with these sulphides. There is very little quartz to be seen. This ground drills easily and, in addition, the walls are good, both of which features permit of economical mining.

In spite of the low price of copper prevailing this property has kept its mill running continuously throughout the year.

With the exception of the operations of the *Iron Mask* mine, nothing but assessment-work has been done on any other property in the district.

Near Jacko lake G. J. Rogers spent considerable time on the *Monte Carlo* and *Ajax* groups. On the *Monte Carlo* a 50-foot shaft has been sunk, the dump of which runs a trace in gold and silver and 3 per cent. copper. Owing to the heavy wash the vein cannot be traced any distance either way from the one point where the shaft is located.

A narrow vein on the *Hercules*, of the *Ajax* group, can be followed on the surface for several hundred feet. A sample taken at one point of typical-looking ore ran a trace of gold and silver and 2.4 per cent. copper. There is no great tonnage, however, to be expected from the look of things on top.

On the *Python* group, a couple of miles east of the *Iron Mask*, there is a fairly big surface showing of a very fair grade of chalcopyrite ore. A lower tunnel, which was not accessible, did not appear, from the look of the dump, to have encountered much ore. The owner, however, claims that still further work can very easily remedy matters in this respect. This property is owned by Sheriff W. F. Wood, of Kamloops.

Scattered here and there throughout the district are a number of copper-showings, the mineralization sometimes covering a considerable area; the grade of the ore being usually the doubtful factor. The fact remains, however, that, with copper more in demand, some of them would be worth further development.

Some high-grade veins have also been developed. To give an instance: The *Copper King* mine on Cherry creek, some 18 miles west of Kamloops, is said to have shipped in early days about 1,000 tons of ore which ran 4.4 per cent. copper and approximately $6 in gold.

The Seymour Arm district on Shuswap lake, was visited by several engineers during the past season, but no properties, however, were bonded. The main trail from the lake to the camp has been greatly improved.

This district is described at some length in the Annual Report for 1922, pages 149 and 152.

HIGHLAND VALLEY AREA (PART OF).

Very little beyond assessment-work has been done in this area during the course of the year.

Recent developments in the States, and more particularly at Bingham Canyon, Utah, in connection with the treatment of low-grade copper-carbonate ores are peculiarly interesting in view of the large exposures of this type of ore in the *Snowstorm* group. On this property are acres of 0.5-per-cent. ore, 100 feet of 1-per-cent. ore exposed in a shallow tunnel, and a more limited amount of 1.5-per-cent. ore.

LOUIS CREEK AREA.

The *Homestake* mine on Louis creek, described in the Annual Report for 1922 is now under bond to J. Tretheway. The main values are in silver.

BARRIERE LAKES AREA.

The situation in the Barriere Lakes area remains about as described in last year's Annual Report.

The Johnson Bros., owners of the *Anaconda* group, located in this vicinity, have been doing some prospecting to the north and west of North Barriere lake and are reported to have found some high-grade ore. This is in the general direction of the Chu Chua district and close to the granite. This new ground would therefore appear to be favourably located. No opportunity was afforded of visiting this new territory.

On the east side the Barriere river, just south of the outlet of North Barriere lake, some work has been done this season on the *Silver Minnow* group, owned by Ralph Hainer, of Barriere. Some galena carrying good silver values is reported to have been opened up.

CHU CHUA AREA.

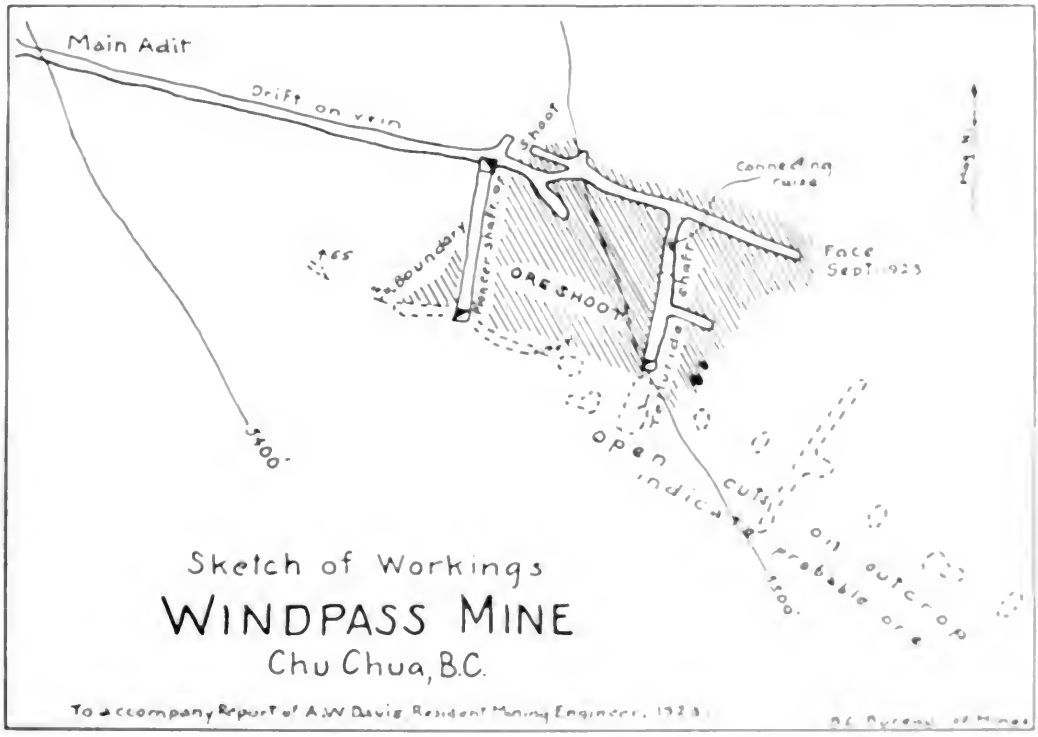
Much territory included in the Kamloops Mining Division is without even trails giving access to it. The Canadian National Railway was not in existence until recent years, and the North Thompson area was so isolated that it received very little attention. East and west of the North

Thompson river, including the Clearwater River drainage [illegible] unprospected.

Windpass. This mine, located near Chu Chua, on the [illegible] included in the area just referred to. The [illegible] The vein on the surface was almost entirely [illegible] the merest accident that it was discovered. The original owners [illegible] wards bonded the property to Trites, Woods & Wilson of [illegible] developed the *Premier* mine at Stewart. The late General R. G. [illegible] the man who induced them to bond the property and who had [illegible] death, and to him is due the successful results now being attained.

Until this summer several hundred feet of underground work had been [illegible] but, once encountered, the results have been most satisfactory [illegible]

The vein, at an elevation of 5,400 feet above sea level, lies in a [illegible] the granodiorite batholith of which Mount Bolduc, the highest [illegible] the core. The values are practically all in gold. The gangue [illegible] a little calcite in the cracks. A little chalcopyrite is also occasionally [illegible]

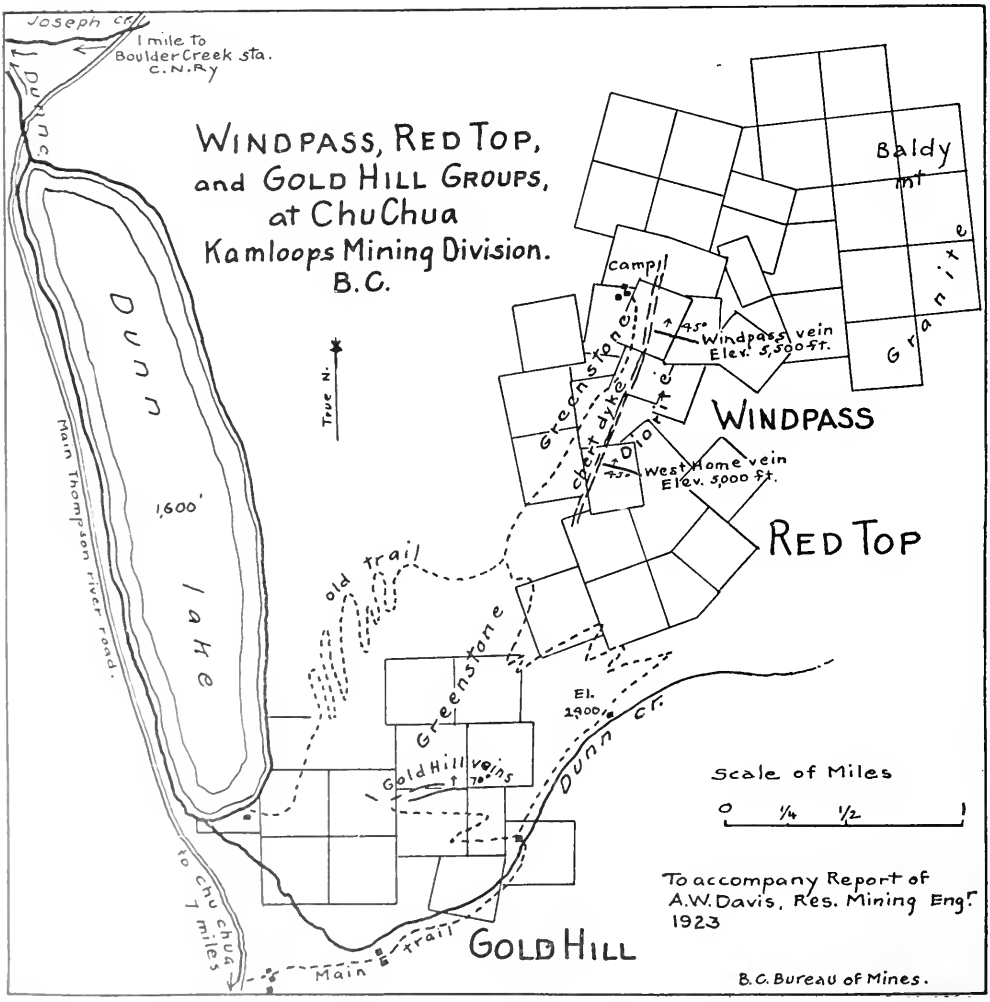


grade of ore some native gold and also [illegible] quartz in sight. This would appear to be primary ore with a good [illegible] long distance vertically.

Although the *Windpass* vein has some [illegible] which will permit of the broken ore running to the stopes. The ground is hard and [illegible] timbering will be required. In fact, conditions are good for [illegible] appears to be a replacement of the country rock along a certain [illegible] seem to be a strong probability that, by actually tapping a wider [illegible] would be indicated at present as very profitable. Other [illegible] foot and hanging walls which will carry enough values to permit of [illegible] average values in the 300 feet now drifted along the vein [illegible] where the ore was first encountered near the Winze shaft to the [illegible]

samples taken at frequent intervals, $38 in gold, with very little silver; the average width of ore sampled being nearly 4 feet. Owing apparently to the rake in the ore-shoot, the lower part of the Pioneer shaft does not show much ore. The inner shaft, called the "Telluride" shaft, is all in ore. The outcrop of the vein for some distance beyond the present face of the tunnel shows enough values to indicate the probability of the ore-shoot continuing farther.

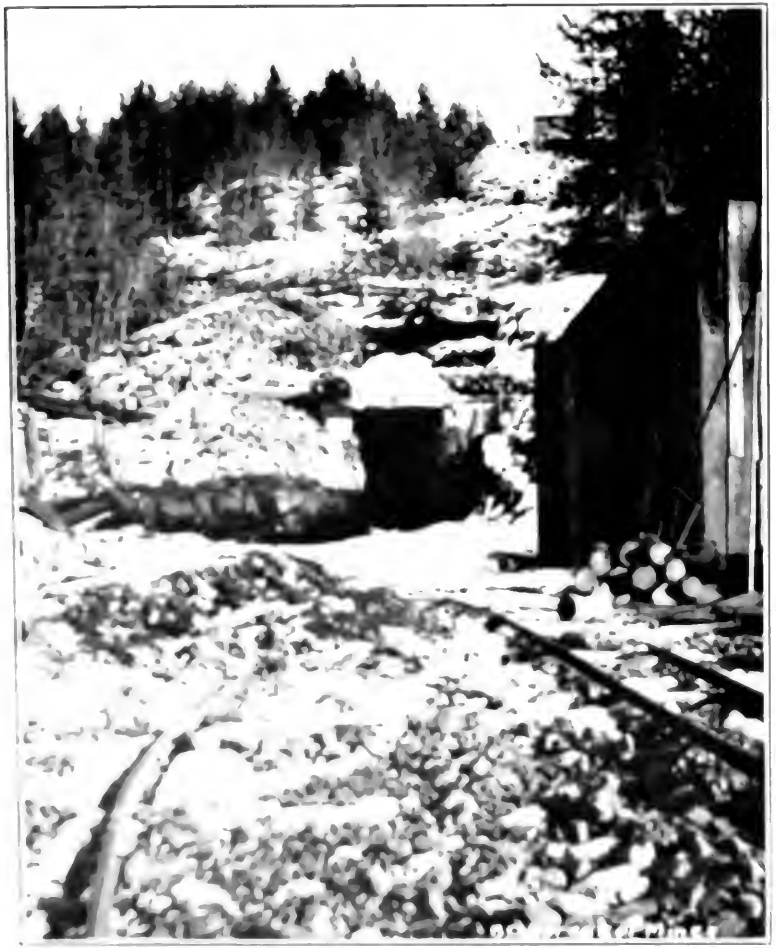
The Sweet Home vein in the same group is the ordinary type of quartz vein, with some telluride also in evidence. This vein, while very narrow on the surface, shows definite and consistent improvement, both as to grade and width, in a 55-foot shaft sunk at one point. The values here are also gold. A little pyrrhotite and a very little chalcopyrite are found in the vein. The assay records, taken about every 3 feet, when sinking the shaft was in progress, give an



average value of $31 in gold across 2 feet for its entire depth. The Sweet Home vein can be followed on the surface for several hundred feet and shows considerable persistency.

The management of the *Windpass* group is taking steps to install a compressor at the mine. Plans are also being prepared in connection with a campaign of construction which will culminate in placing the property on an operating basis.

A satisfactory milling process will no doubt be worked out. The present idea is to place this mill on the Canadian National Railway near Boulder Station and to connect it with the mine by an aerial tramway.



Windpass Mine, Kamloops M.D.

St. Paul Mine, Vernon M.D.

A good water-power development is fortunately available. Dunn lake, in the vicinity of the property, can be used as a storage-reservoir, whilst Joseph and Dunn creeks combined afford an ample supply of water.

Gold Hill Group. This group, owned by George Fennell and H. Skoning, of Chu Chua, lies in a south-westerly direction from the *Windpass* mine. This property has attracted considerable attention this year. On it are exposed some very promising-looking outcrops. The values are mainly in gold. Very little underground work has been done on this ground as yet, although it is well worth it. The elevation of the more important outcrops are in the neighbourhood of 4,000 feet above sea-level.

Two parallel veins are exposed for some distance on the surface, the strike being approximately east and west and the ground rising as the veins are followed in a westerly direction. The lower of the two veins is called No. 1 vein and the upper No. 2 vein. These two veins have the same characteristics; they are both quartzose and carry a small amount of iron pyrites and galena. Their width is around 3 or 4 feet. No definite ore-shoot has been developed on the surface as yet, but the gold values obtained here and there on top are good enough to warrant a campaign of underground work. The satisfactory results of such work on the Sweet Home vein about a mile away are an additional argument in favour of this course.

Assay returns on some samples taken by me this season are given below:—

	Gold Oz.	Silver Oz.
No. 1 Vein—		
(1.) Sample across 8 feet (including some mineralized wall rock)	0.02	0.8
(2.) Sample taken at same point as (1) on subsequent visit when cut made a little deeper	0.10	0.20
(3.) Sample of well-mineralized material from cut about 100 feet west of (1)	1.00	0.40
(4.) Sample of well-mineralized material from cut about 70 feet still farther west	0.02	3.20
(5.) Some of the poorer-looking vein-matter taken from various cuts when going along the vein	0.10	1.2
No. 2 Vein—		
(1.) Well-mineralized material from one cut	0.40	2.0
(2.) Well-mineralized material from cut 100 feet farther west	0.56	0.6
(3.) Some of the poorer-looking vein-matter collected from two or three cuts on the vein	0.40	2.0

On what is probably an extension of No. 2 vein, a few hundred feet to the west from its most westerly exposure, an open-cut exposes a narrow fissure showing some gouge material in which some bunches of extremely high-grade gold ore have been found. The dip of this fissure is about 80° to the south, although both Nos. 1 and 2 veins dip at around 70° to the north.

Skoning reports some finds of high-grade float elsewhere in the group.

Red Top Group. This group, adjoining the *Windpass* group on the south-east, has had a little development-work expended on it this year. Some high-grade float has been found on this ground. The highly satisfactory results of the development work on the *Windpass* group render the camp of great interest to prospectors. A dip-needle would not be a bad thing to have along, as, if there be any other magnetite veins in the area buried beneath the surface, this instrument would at once denote their presence.

Describing the geological conditions briefly, there is a granite intrusion in the district the core of which, as has been stated, is Mount Baldie, lying a little east of Chu Chua on the North Thompson river and the Canadian National Railway. The veins so far discovered lie in other rocks on the western contact of the granite. These rocks are diorite adjoining the granite and next to it a greenstone called by Dr. Uglow the "Fennell greenstone." The *Windpass* group veins are in the diorite. On another group in the area, where some definite vein-systems have been located, they are found in the greenstone. The property referred to is the *Gold Hill* group described above.

This granite-contact referred to above extends in a south-easterly direction to a point north of North Barriere lake. Some finds have been recently reported in this neighbourhood.

Going the other way, on Fog Horn creek, back of Birch Island, the granite-contact is again exposed. Quite a few claims are being held in this vicinity. The ground between this last

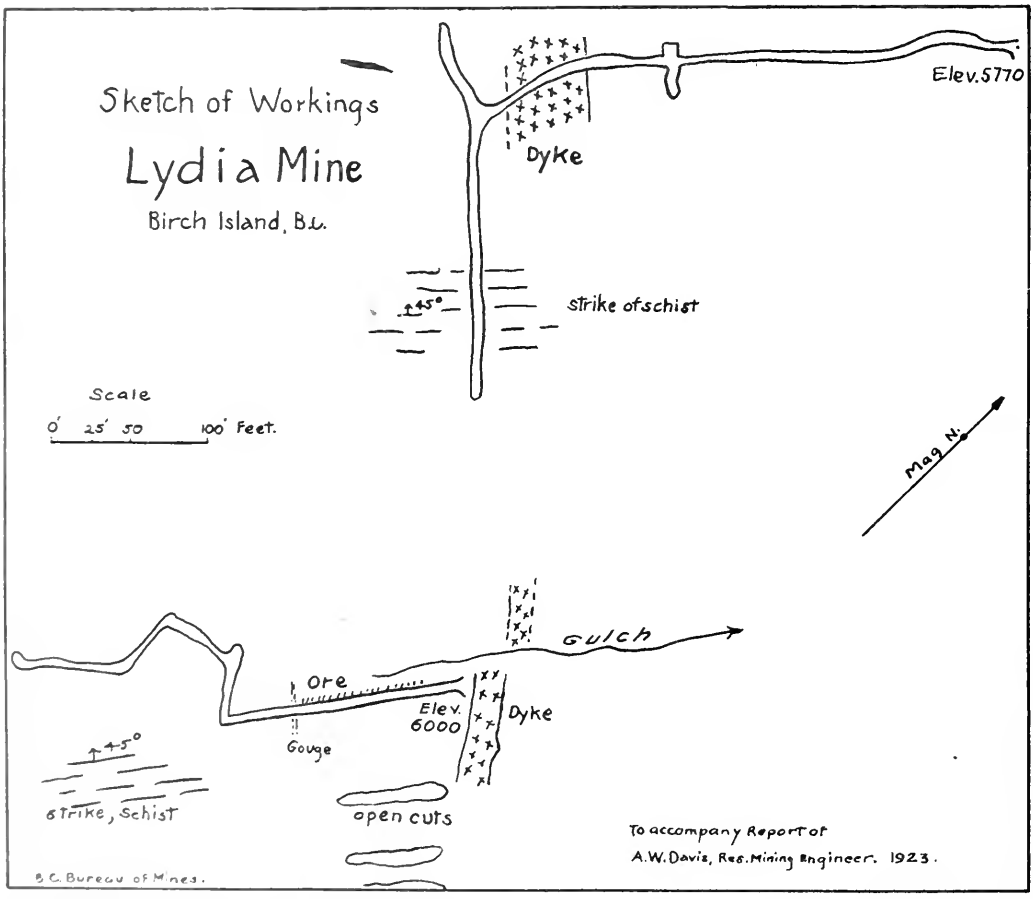
mentioned area, south to the *Windpass* group at Chu Chua, is, I consider, one of the best to prospect.

BIRCH ISLAND AREA.

Considerable mining activity has been in evidence this year on Fog Horn creek, which empties into the North Thompson river from the south at Birch Island, a station on the Canadian National Railway about 80 miles north of Kamloops.

Lydia.

The *Lydia* mine is owned by Geo. Fennell and Axel Shingrom, both of Chu Chua. This mine is about 8 miles up Fog Horn creek from Birch Island, with which it is connected by a good trail. The elevation of the mine is 6,000 feet above sea-level. Most of the underground development carried on within this district has been at the *Lydia* mine, which was under bond to a New York syndicate in 1918. On this



property there is about 900 feet of drifting and crosscutting. The prevailing formation is schist, with an approximate strike of north and south and dipping to the west at about 45°.

At the upper tunnel of the *Lydia*, schist mineralized with iron and copper pyrites was drifted on for about 100 feet. A slip showing some gouge material was then encountered, and although drifting was continued inside of this point, nothing but country-rock was disclosed.

In the development-work this property has so far received it would appear that the theory has been accepted that the copper mineralization is along the strike of the schist, and the work on the lower tunnel, where absolutely nothing was encountered, was apparently projected on that supposition.

The owners of the property, since this work was done, claim to have located ore along the southerly contact of a porphyry dyke which, cutting the formation at right angles, crosses the

mouth of the upper tunnel. It may be that there is something in this, as the dyke shows signs of dislocation near the mouth of the upper tunnel, where a narrow gulch runs down the hillside, and this gulch might easily represent a fault which has cut off the copper mineralization.

These pits, which extend for some distance in a south-easterly direction and at right angles to the direction of the upper tunnel, were full of gravel when the property was inspected by me. I have since been informed by one of the owners that the pits are now cleaned out.

No average sample was taken of the ore exposed in the upper tunnel. It is obviously no high-grade proposition; but at the same time the showing was considered by the locators of the property, themselves experienced mining men, good enough to justify the doing of a lot of underground work at a lower level. If, therefore, there should be ore found in these cuts in quantity and of similar grade to that already encountered, the property may easily be worth another campaign of development.

Minnesota Girl.

On the east side of the *Lydia* trail, about 3 miles from Birch Island, the *Minnesota Girl* group is located. The general impression gained from looking over this ground is that the chance exists here for developing an extremely large body of low-grade lead-zinc ore. A whole bluff of mineralized material is in evidence, badly fissured and broken up, and, whilst the rock would appear to be in place, a number of open cavities are in existence. The main mineralization occurs along the lines of fissuring, which extend in every direction.

At one point where a shallow working exists the dump assayed as follows: Gold, 0.02 oz.; silver, 4 oz. to the ton; lead, 1.5 per cent.; zinc, 5 per cent. Although this assay is low, it must be remembered that if this ground were to be mined at all, it would be on a basis of a couple of thousand tons a day or thereabouts, and costs per ton would be very low.

It must be noted that a lot of the material between the fissuring is practically barren. However, this ground is definitely worth a campaign of surface work.

A tunnel about 250 feet below the shallow working referred to above has been driven into the hill about 100 feet. So far this tunnel has been in altered schist. The ore-bearing formation would appear to be porphyry. The mouth of this tunnel is at the side of the main trail.

The owners of this group are J. W. Schlichter, Chas. and Jos. Cleavely, and John Boulanger.

There are some other groups up Fog Horn creek which were not visited this season, but which would no doubt be well worth referring to if the information regarding them were available.

Within a mile of the *Lydia* mine granodiorite is encountered which the prospectors state is identical with that occurring at Mount Baldie near the *Windpass* mine. These Fog Horn Creek properties are therefore located in the rocks to the west of this formation, and the situation in this respect is similar to that obtaining at Chu Chua.

VAVENBY AREA.

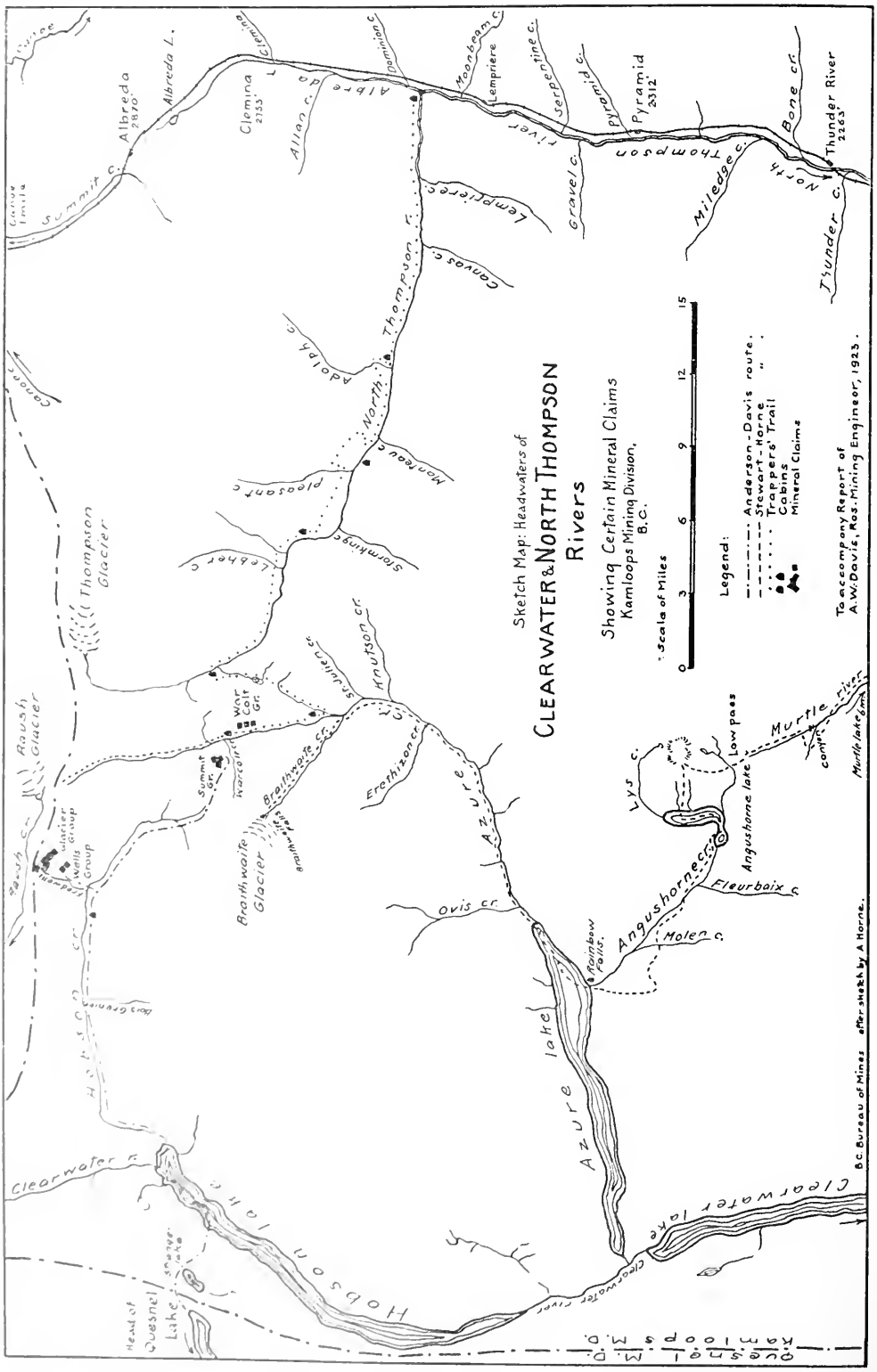
North of Vavenby, on the Canadian National Railway, 86 miles north of Kamloops, Neil Morrison has been carrying on active prospecting and development work on the *Last Chance* and *Naomi* groups, located there. These properties are described in the Annual Report for 1923, pages 145 and 146. It was not possible to visit this ground this year. What information has been obtained, however, regarding the general situation is encouraging. Morrison has succeeded in interesting Angus Benton, of Vancouver, and associates in his various enterprises, and three new cabins have been erected this fall preparatory to a campaign of development work. Considerable new staking has been done as well.

Another group called the *Red Top* has been staked by other prospectors. This adjoins the *Naomi* group on the north-west.

(NOTE.—A property of same name is located adjoining the *Windpass* group.)

NORTH CLEARWATER AREA.

This is one of the large areas referred to in a previous paragraph which, in a great many cases, is not even penetrated by trails. To give an example, two prospectors, G. S. Stewart and Angus Horne, of Blue River, this summer, starting from near the source of the North Thompson river, travelled south down Braithwaite creek to Azure lake, which is in the Clearwater drainage area. Thence they went across country to Murtle lake and down Blue river to its mouth on the North Thompson river. A lot of this country is not even mapped. Between Azure lake and


Sketch Map: Headwaters of
CLEARWATER & NORTH THOMPSON
Rivers
Showing Certain Mineral Claims
Kamloops Mining Division,
B.C.
Scale of Miles
0 3 6 9 12 15
Legend:
Anderson-Davis route.
Stewart-Horne "
Trappers' Trail
Cabins
Mineral Claims
To accompany Report of
A.W. Davis, Ros. Mining Engineer, 1923.
B.C. Bureau of Mines after sketch by A Horne.
Albreda 2870'
Albreda L.
Clemina 2753'
Clemina
Allan c.
Dominion c.
Moonbeam c.
Lempriere
Serpentine c.
Pyramid c.
Pyramid 2312'
Bone cr.
Thunder River 2263'
Thunder c.
North Thompson river
Gravel c.
Mileage c.
Lempriere c.
Canvas c.
North Thompson r.
Adolph c.
Monteau c.
Pleasant c.
Stormking c.
Lebher c.
Thompson Glacier
Canoe c.
Rausch Glacier
Rausch cr.
Glacier Group
Wells Group
Summit c.
Summit Gr.
Warcolt cr.
War Colt Gr.
Braithwaite cr.
Braithwaite Falls
Braithwaite Glacier
Erethizon cr.
St. Julien cr.
Knutson cr.
Azure cr.
Ovis cr.
Rainbow Falls
Azure lake
Angushorne cr.
Angushorne lake
Low pass
Lys c.
Fleurbaix c.
Molen c.
Murtle river
Murtle lake
Canyon
Clearwater r.
Clearwater lake
Clearwater river
Hobson lake
Hobson cr.
Head of Quesnel Lake
Shangri lake
Quesnel M.D.
Kamloops M.D.

Murtle lake they found a large lake which neither they nor anybody they had ever met knew anything about. This they called "Cedar lake," now named Angushorne lake. Being short of food, very little prospecting was done, but their intention is to return to this country again the look of which appealed to them.

For several years a small group of prospectors has been carrying on operations in Braithwaite basin and its vicinity. At or near this point, which has an approximate elevation of [illegible] 5,000 feet, several streams have their origin. The North Thompson river has its source in [illegible] Hobson creek, flowing into the north end of Hobson lake, rises in the vicinity; and the Raush river, rising just north of Braithwaite basin, flows in a northwesterly direction into the Fraser.

If the camp should develop successfully, the proper outlet is down the Raush river to its mouth. The gradient for a road would be very light and a big open valley obtains for most of the distance, which would be at least 50 miles.

For preliminary development a trail 18 miles long constructed down Hobson creek would connect the camp with Hobson lake, to which point supplies could be brought in, mostly by water, from Quesnel Forks.

At the present moment a very rough horse-trail down the North Thompson river connects Braithwaite basin with the Canadian National Railway. The worst feature of this trail is the high summit it goes over in crossing from the North Thompson to the Clearwater drainage area. The total length of this trail is about 40 miles.

War Colt Group. This group is located on the east side of Braithwaite creek near its source. On *War Colt No. 1* claim, in the immediate vicinity of the creek, some work has been done on a showing of complex ore consisting of a mixture of galena, zinc-blende, chalcopyrite, and pyrite. A sample taken of the higher grade material ran: Gold, 0.06 oz.; silver, 15 oz. to the ton; copper, 5.5 per cent.; lead, 16 per cent.; zinc, 20 per cent. Some less-mineralized material ran: Gold, trace; silver, 5.5 oz. to the ton; copper, 1.2 per cent.; lead, 12 per cent.; zinc, 10 per cent. There is considerable ore at one point, but its continuity is the doubtful factor. Its strike is north-west and south-east. In a southerly direction from the main showing it appears to play out. Going the other way, the creek and glacial drift beyond it prevent its being examined. The formation in the vicinity is schist and the vein seems to conform with the formation.

On *War Colt No. 2* claim of the same group, also on the east side of the creek and about 600 feet in elevation above it, is located another vein on which some underground work is being done this winter. Heavy wash prevents a satisfactory examination of the outcrop. At one point where the vein has been stripped up and down the hillside for 25 feet an average sample taken over this distance ran: Gold, 0.36 oz.; silver, 1 oz. to the ton. The vein-matter is quartz showing a little iron and copper stain. The country-rock here is also schist. The strike of the vein is obscure and the sample taken may have been more or less along the strike instead of across it.

The owners of this property are Adolph Anderson and L. Knutson, of Alberta.

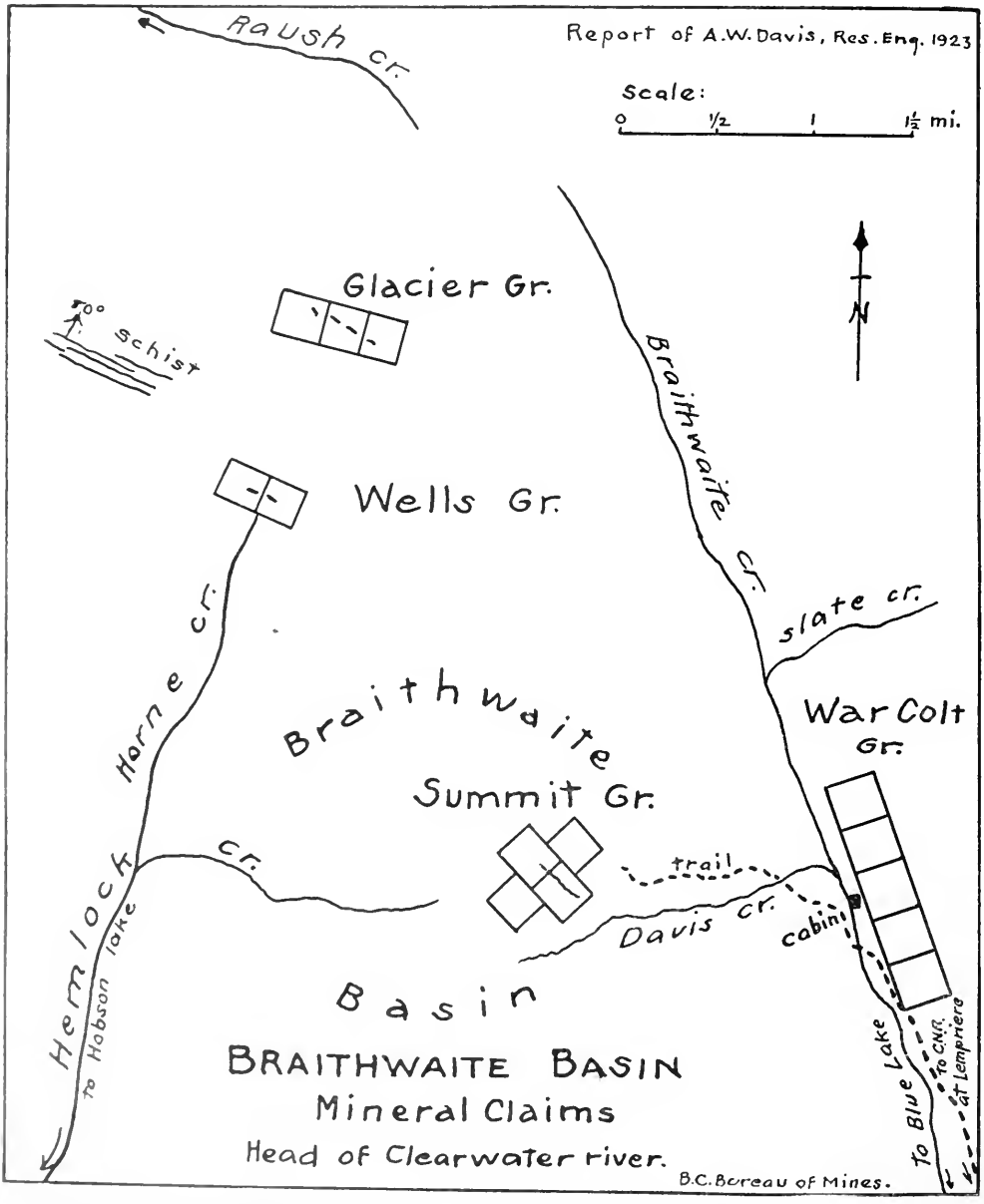
Summit Group. This group is located about half a mile to the west of Braithwaite creek. The country-rock is also the prevailing schist. The main vein, so far as opened up, has a width of over 25 feet and a north-westerly strike conforming with that of the prevailing schist. A tunnel driven across the vein at one point is in 25 feet, with ore still in the face. An average sample taken of the dump from this working ran: Gold, 0.40 oz.; silver, 0.20 oz. to the ton. A sample taken of some heavily mineralized material at the face of the tunnel ran: Gold, 0.60 oz.; silver, 1 oz. to the ton. On the surface above the tunnel and about 25 feet to the south-east of it a sample taken from a small pit ran: Gold, 0.60 oz.; silver, 4 oz. to the ton. Very little galena was in evidence here.

The vein-matter is quartz, rather heavily mineralized with iron pyrites. There is evidently a large body of ore at this point carrying about $8 or $9 in gold. No attempt has as yet been made to trace the vein for any great distance, either way, from the location of the tunnel and the future of the property will depend to a large extent on the results of such work. This is apparently a lens of quartz lying in the prevailing formation. If big enough, however, and also if other lenses can be developed in the vicinity, it may easily become of economic value.

In a westerly direction some 1,000 feet from the tunnel just described a quartz vein 4 or 5 feet wide is exposed, with a north-and-south strike. A sample taken here ran: Gold, 0.14 oz.; silver, 1.5 oz. to the ton. Besides pyrite a little zinc-blende and yellow copper can also be seen.

There are also a number of other quartz-outcrops in the vicinity the relations of which with each other are more or less obscure. The general impression given, however, would appear to be that a campaign of surface work in this neighbourhood would be well worth while.

The group as a whole looks promising; for, with the chief values in gold, far back as it is, with tonnage developed, it might still be worked to a profit.



The owners of the *Summit* group are G. S. Stewart, Angus Horne, and Norman Anderson, all of Blue River.

Fred Wells, the veteran prospector and mining man, visited the camp in the late summer of 1923 and staked a couple of claims on Fredwells creek, a tributary of Hobson creek. This ground is about 2 or 3 miles in a westerly direction from the *Summit* group described above.

The values are reported to be mainly in gold and the vein in question is said to show considerable continuity. This ground was not examined by me.

At the headwaters of the Raush river high-grade grey-copper float is reported by the prospectors.

ASHCROFT MINING DIVISION.

Highland Valley Area (Part of).

This district was visited by several engineers during the season and hopes were entertained that some active development-work might result. The drop in the price of copper last summer, however, nipped these hopes in the bud.

Very little beyond assessment-work has been done in this area during the course of the year.

Some work has been done by J. N. J. Brown on the *Kathleen* group, where a high-grade bornite vein has been opened up.

George Novak, of Rossland, visited the camp during the season and did a limited amount of work on the *Highland* group, referred to in last year's report.

There are large exposures of low-grade copper-carbonate ores in the *Snowstorm* group. On this property are acres of 0.5-per-cent. ore, 100 feet of 1-per-cent. ore exposed in a shallow tunnel, and a more limited amount of 1.5-per-cent. ore in various cuts on the surface.

While secondary enrichment is not possible here, the combination of circumstances may be such that where the sulphide-zone begins the copper values may increase. This ground so far has had no drilling done on it. As of interest, it should be stated that diamond-drilling on an adjoining claim in connection with a small high-grade vein located there shows the copper occurring as bornite to as great a depth as 700 or 800 feet below the surface.

H. Graham, the Indian Agent at Lytton, reports the discovery of a vein by the Indians. A sample of quartz sent to this office ran 0.12 oz. in gold and 8.6 oz. in silver to the ton. This ore is reported to be in quantity and will be investigated in the spring.

Hat Creek Coal (Lignite).

This coal area is described in 1878 by Dr. G. M. Dawson, of the Geological Survey, Canada, and his report was distinctly favourable. (See Annual Reports of Geological Survey, Canada, for 1878 and 1886.)

This coal, as it is exposed on the surface, while lignite, burns well and has a commercial value. An analysis of the lignite was made by Dawson and results as follows:

	Per Cent.
Water	8.03
Volatile combustible matter	35.51
Fixed carbon	46.84
Ash	9.62

A spur-line of about 16 miles would connect this area with the Pacific Great Eastern Railway at Pavilion, and with the large amount of coal demonstrated by the drill holes the construction of this road might be considered.

This lignite-deposit is now owned by the Clear Mountain Coal Company, Limited, of Vancouver, and active steps are being taken to prospect it.

VERNON MINING DIVISION.

White Elephant Group.

No systematic development-work has been done this year on the *White Elephant* group, located on the west side of Okanagan lake and referred to in some detail in the Report for 1922. What this property needs is a shaft down 150 feet or so, with some crosscutting and drifting. The ore exposed on the surface fully justifies this expenditure, which would not be very great. Ten thousand dollars spent the right way would no doubt greatly clear up the situation. The surface showing merits such an expenditure.

During the year some staking was done in the vicinity of the *White Elephant*, and there are two or three other groups also in existence on which well-defined quartz veins are said to be exposed. Arthur Cochrane, of Vernon, is interested in one of them. An opportunity was not afforded me of visiting this ground during the season.

St. Paul.

This mine is located on the Monashee or Rembler creek, near the Monashee summit, and about 50 miles from Vernon. With the exception of the 2 miles of branch road at the mine end, which are out of repair, a first-class wagon-road connects the two points. A quartz vein varying from a few inches to 3 or 4 feet in width is exposed on the property, with a strike roughly of north-west and dipping to the north-east at about 30°. The quartz has associated with it a small percentage of pyrites. This vein has been worked at two points about half a mile apart, with the ground heavily covered by wash in between, and, as a matter of fact, there is no conclusive proof that there is only one vein involved.

At the lower workings the vein has been drifted on for 20 feet, with 4 feet of ore in the face. A tunnel was then started 100 feet vertically below this working and is now in the hill a distance of about 380 feet. This last working would appear to be in the hanging-wall of the vein. A survey is badly needed. The elevation of these lower workings is about 4,600 feet above sea-level.

The upper workings, separated from the lower workings by a lot of unprospected ground, are located about half a mile distant in a south-easterly direction and are at an elevation of about 5,600 feet. Here the outcrop of the vein is exposed for about 300 feet along the strike. An 80-foot vertical shaft has been sunk in the hanging-wall at this point to intercept the vein. This working is full of water. The owners report 18 to 24 inches of $50 ore in sight at the bottom, and that the lack of machinery and consequent inability to cope with the water which they struck when the vein was encountered prevents them from working at this point.

Samples taken at the upper workings ran as follows: (1) 0.02 oz. gold; (2) 0.01 oz. gold; (3) 0.32 oz. gold; (4) trace of gold; (5) trace of gold to the ton.

The formation near the vein is a slate, with some igneous rock exposed in the 380-foot tunnel driven in the hanging-wall at the lower workings.

Samples taken indicate that in the face of the 20-foot tunnel there is 4 feet of ore averaging around $4 in gold and silver, mostly gold. At the mouth of this same tunnel a sample across 2 feet of ore ran 0.14 oz. in gold and 10.38 oz. in silver to the ton. This is equivalent to a total value of about $9.

On the top of the hill, where the upper workings are located, the open-cuts are all caved in, and therefore practically nothing can be seen. The samples taken were from the poorer but accessible parts of the vein where no underhand stoping had been attempted, and therefore are obviously not indicative of the average run of the ore.

A 1-stamp mill has been erected on the property. The assay of ore left in the ore-bin at the mill ran only 0.38 oz. in gold and 0.30 oz. in silver to the ton; or a total value of about $7.60. No doubt the recovery in the mill of the 130 tons treated was $22 a ton, as stated by the owners. It is quite likely that, as the ore taken from the surface cuts became harder to get, a lower grade of material than the average was reached towards the end of operations. A sample of the mill tailings ran: Gold, 0.14 oz.; silver, 0.08 oz. to the ton.

There must have been some nice-looking ore on the surface to yield the recovery claimed, and these surface cuts should be thoroughly cleaned out in the spring to permit of some accurate sampling being done there. It would then be possible to form some idea as to the chances for opening up ore in quantity at this point. If these surface cuts looked good, a crosscut tunnel 300 or 400 feet long would give about 100 feet depth on the vein and might be considered.

It would not appear good policy to do any more work—for the time being anyway—in the crosscut tunnel driven in for several hundred feet below the 20-foot tunnel referred to above. The grade of the ore in this last working would not appear to justify it, although the 20-foot tunnel is well worth drifting on. This property is owned by Angus Woods, of Lumby, and associates.

Porcupine Creek Placer.

On Porcupine creek, a tributary of Monashee or Rembler creek, and within a couple of miles of the *St. Paul* mine a little placer-mining was attempted this year. According to an old story, the placer-miners in the seventies located coarse gold at the point where Porcupine creek empties into Monashee or Rembler creek, but could never work the bed-rock on account of the water. These men then started to drive a 1,400-foot tunnel from a point lower down on Cherry creek to reach this point. Owing to a horse-shoe bend in the creek this tunnel would give them ample depth. The story is that they drove 600 feet and then abandoned the enterprise.

B.C. Bureau of Mines

B.C. Bureau of Mines

This summer, when on the ground, the direction of this old working, which is caved in, was picked up and a line run with a compass through the brush and over an intervening ridge. Verifying the old story, it was found to head straight for the junction of the two creeks.

The present owners have been doing some prospecting up Porcupine creek. It would appear a sound policy to sink a shallow shaft at the point where these good values were supposed to exist and to then be governed by the results obtained. The owners of this ground are T. C. Yeoward and associates, of Armstrong.

A discovery of copper ore is reported by H. J. Blurton, of Mara, on the west side of Okanagan lake, north of Siwash creek.

Octagon Group.

About a mile west of the extreme north end of Okanagan lake some work was done this season on the *Octagon* group of mineral claims. This is new ground.

One open-cut and short incline show several feet of quartz carrying, near the surface, a little grey copper, zinc-blende, and iron pyrites. The vein has not been traced for any distance and appears to be more or less of a lens in the prevailing formation. The owners of the property are F. Jewel, H. Allison, and F. Holsinger.

Brent Property.

During the summer Wm. Brent, of Vernon, located some copper ore on the east side of Okanagan lake, about a mile to the south of its extreme north end.

The prevailing formation here is schist, with a north-west strike and a dip of about 70° to the north-east. The vein exposed by Brent conforms with the formation. The width is around 3 or 4 feet. The vein-filling is quartz, with the copper occurring as malachite and chalcopyrite. The following samples were taken:—

(1.) Across 3.5 feet on foot-wall (quartzose material): Gold, trace; silver, 4 oz. to the ton; copper, 2 per cent.; lead, 1 per cent.

(2.) Across 4 feet on hanging-wall, same point as (1) (yellowish schistose material): Gold, trace; silver, 0.6 oz. to the ton (not assayed for anything else).

(3.) General sample along foot-wall (across a couple of feet) for about 25 feet: Gold, trace; silver, 4.6 oz.; copper, 3.6 per cent.; lead, *nil*.

(4.) A picked sample: Gold, trace; silver, 5.6 oz. to the ton; with very little copper in evidence.

Samples (1), (2), and (3) were all from the same open-cut, which has stripped the vein for about 25 feet along its strike. Sample (4) is from a cut about 400 feet to the north-west and is apparently on the same vein, although intervening wash prevents tracing the vein through. The vein is narrow here.

Sizing up this proposition, it would appear that if a similar type of ore to that shown in the 25-foot cut could be exposed along the surface for 200 or 300 feet, the group would be worth some underground development. Its position, a few hundred feet above Okanagan lake and about half a mile distant from it, is excellent.

During the season high platinum assays were reported from certain horizontal narrow volcanic dykes occurring at intervals in the bluffs overlooking Mission creek, about 5 miles above its mouth at Kelowna.

A company formed in Coeur d'Alene City had this ground staked and was claiming these high platinum values, but an investigation of this area proved the complete absence of platinum in this formation.

NICOLA MINING DIVISION.

Mining still remains practically at a standstill in this Division. Similarly to last year, a rumour has been going the rounds recently of the *Nonoma* mines at Stump lake starting up operations again. This is a shaft proposition and very little can be stated in connection with the property until the workings are unwatered and an opportunity afforded of inspecting them.

Vimy Ridge Group.

This group is located about 14 miles up Guichon creek, which empties into the Nicola river at Coyle, a point on the Nicola branch of the Canadian Pacific Railway about 6 miles below Merritt. About 1½ miles of easy road construction would connect the property with the Thrasher mine, which is connected with the railway at Coyle by a good wagon road down Guichon creek, 12 miles long.

The claims are at an elevation of about 3,800 feet above sea level. The formation would appear to be an altered volcanic rock. According to Dawson's geologic map of the district, the

eastern contact of the big area of granite which extends as far as Highland valley must be somewhere in the vicinity.

A tunnel, or rather slope, has been driven into the hill at one point for about 100 feet. It is now caved near the mouth. This tunnel is said to intercept a 10-foot lead of decomposed oxidized material which has a strike of north and south and a flat dip to the east. This vein is exposed in an open-cut about 100 yards to the north of this working. An average sample ran: Gold, trace; silver, 0.6 oz. to the ton; copper, 14.7 per cent. The copper is practically all in the carbonate form.

A few hundred yards to the east of these workings, about 20 tons of bornite ore was at one time shipped from some open-cuts and a short tunnel. The high-grade bornite, however, was in a series of narrow seams and did not last. The owner of this property is Jacob Zinc, of Merritt.

Aberdeen. This mine shipped, with very little development-work, a number of cars (report says about thirty) of high-grade bornite ore during the war. This ore was sent to three different smelters, and as there are no local records available, no definite figures can be obtained. It would appear, however, worth looking over as a source of high-grade copper ore.

Coal-mining (Merritt Field).

The Middlesboro Collieries, Limited, produced 75,862 long tons of coal during 1923.

The Fleming Coal Company, Limited, produced 3,954 long tons of coal in the first three months of 1923. Operations were then stopped by this company, with the exception of prospecting in a small way to locate more coal. Work again started at this mine in November, 1923, and Joseph Graham now reports as follows:—

"The Keystone Coal Company, Limited, has taken a bond on the property and is now driving a slope to open up what is known as the 'Big No. 1 Seam.' The indications are encouraging and it is anticipated that the seam will be encountered within sixty days. As all the plant and equipment are on hand to handle 500 tons a day, production may be resumed by spring."

The Diamond Vale mine is still unworked and nothing was done at the Normandale mine during 1923.

YALE MINING DIVISION.

Hope Area.

A map of this area is given on page 142 of the Annual Mines Report for 1922.

Emancipation. This mine, located on the Kettle Valley Railway about 17 miles east of Hope, has been shut down throughout the year. This is a gold property and is referred to at some length in the Report for 1922. Further development is badly needed here. When the mill was last operated there was very little ore blocked out in advance. Furthermore, the capacity of the mill was only a few tons a day, the result being that the ore which was run through it did not yield the profit that it might have with a mill of reasonable capacity. This mine is very favourably located and well merits some further attention.

Ladner Creek. A number of properties on Ladner creek were described in the Annual Report for 1922. There has been practically nothing done in this area this year beyond a little assessment-work. It has been a case of marking time and waiting for some favourable development in the vicinity which would revive interest in the camp.

Sowaqua Creek (formerly Pierre Creek) Placer. Captain J. D. Fullbrook and associates, of New Westminster, have carried on vigorous development-work on their placer leases located on this creek. A good trail 5 miles long, with easy gradients, now connects the workings with the Kettle Valley Railway at Jessica. Two shallow shafts were sunk and considerable open-cutting done this year and a substantial camp erected. A series of low benches occur on Sowaqua creek, where the work has been done, in which gold and platinum values are obtained. It would appear that the only feasible method of working this ground would be to divert the whole creek and to hydraulic the creek-bottom from rim to rim, including in the operation the benches which have so far been prospected. This is quite an expensive proposition, and as a preliminary some further development-work is necessary in order to acquire more definite information as to average values than is now available.

Some tests were made of this ground early in December, 1923, by the writer and results are given below:—

No. 1 Test.—Ground sluice on No. 3 lease (¼ yard put through rocker): Riffle concentrates 19 cents a yard in gold; blanket concentrates, 16.6 cents a yard in gold and 1.1 cents in platinum; total value of gravel, 36.7 cents a yard.

No. 2 Test.—Windlass shaft on right side of creek on bench (⅛ yard put through rocker): Riffle concentrates, 13.3 cents a yard in gold and 0.6 cent in platinum; blanket concentrates 437 cents a yard in gold, 1.3 cents in silver, and 1.3 cents in platinum; total value, 453.5 cents a yard.

No. 3 Test.—From 10-foot shaft near left bank of creek (¼ yard put through rocker). All concentrates together, 2.4 cents a yard in gold.

In making the above tests it was assumed that, for every yard of material such as was handled above, half a yard exists as boulders.

The following results were obtained by the owners during the course of the season, according to a statement submitted by them:—

(1.) Amount of material tested: 43 lb. sand. Calculated value to the ton: Gold, $3.68; platinum, 23 cents; total, $3.91.

(2.) Amount of material tested: 15.25 lb. sand. Calculated value to the ton: Gold, $9.73; platinum, 69.6 cents; total, $10.43.

(3.) Amount of material tested: 7.5 lb. sand. Total value to the ton, $32.13.

(4.) Amount of material tested: Sluice concentrates (quantity handled unknown). Calculated value to the yard: Gold, 26 cents; platinum, trace; total, 26 cents.

(5.) Amount of material tested: 20 lb. gravel (1 pan). Total value, $1.47 a yard.

(6.) Amount of material tested: Quantity unknown. Test indicated $2.26 a yard.

(7.) Amount of material tested: Quantity unknown. Test indicated $1.80 a yard.

Siwash Creek Placer.

Situated near Yale. This ground is referred to on page 143 of the Mines Report for 1922. During the year the owner of this property took out a certain amount of gold, working alone on a very primitive scale. By deepening the channel of the creek just below where the placer ground is located a flume could be carried up the creek at a grade which would carry off the tailings. A variation of this would be to drive a tunnel, which would achieve the same purpose. There is at present a tunnel now in existence at this point, which, however, lands at its objective only a very few feet below the present creek surface instead of 30 or 40 feet down, or wherever bed-rock at this particular point should happen to be.

Neither of the plans suggested above should be very expensive. To carry on operations successfully here the whole creek must be diverted into a flume to permit of hydraulicking.

The owner of this property, John McGregor, of Hope, has succeeded this year in interesting a Seattle company in the enterprise, and it is to be hoped that successful developments may occur next year. As a preliminary there should be some drilling, or at any rate shaft-sinking, to acquire information both as to values and the location of bed-rock.

Gold Group.

This property is located near the head of Hillsbar creek, which enters the Fraser river from the east about 3 miles below Yale. An exceedingly steep trail (since improved) about 4 miles long connects the Canadian National Railway with the workings, which are at an elevation of about 2,740 feet above the track.

Two parallel quartz veins are exposed, crossing a steep watercourse. On the upper one of these a 40-foot tunnel had been driven last spring. Some high-grade free gold was found in the vein near the mouth of the tunnel; but the face when visited last summer was barren. Recent reports would indicate that more high-grade ore has since been found.

The country where this work is being done is approximately an extension of the mineralized zone obtaining on Ladner creek and is therefore worth watching.

Twenty-three-mile Camp.

This camp was visited during the summer and a number of properties occurring in the vicinity looked over.

Silver Daisy.

This property is located on the east side of the Skagit river just south of where Sumallo creek empties into it. The formation is chert. The vein has been drifted on for about 75 feet at a point about 200 feet in elevation above

the valley, although the ore is not continuous for this distance. The dip is about 70° west and out of the hill, so that a lower tunnel which it is planned to drive will not have a very great distance to go. The ore exposed in the working will only average a few inches in width; it is, however, fairly high grade.

A few tons of ore is lying near the mouth of the tunnel, which constitutes the reject from a small shipment of high-grade ore (with considerable galena in it) made some time ago. A sample of this rejected material ran: Gold, 0.06 oz.; silver, 153 oz. to the ton; lead, 6 per cent.; zinc, 25 per cent.

This property, originally owned by W. H. Robinson, of Hope, and associates, is now under bond to the Canadian Superior Mines Company, of Seattle.

Diamond Group.

This property, owned by Frank Fritz, of Hope, was also visited. Unfortunately he was absent, so it was necessary to look over the showings without him.

The group is located on the west side of the Skagit river and only a mile or so from the *Silver Daisy*. The lower workings, and what would appear to be the principal showings, are located about 400 feet above the valley. At this point (to which the trail leads) a lot of open-cutting has been done. The formation would appear to be an altered limestone with a lot of silica in it.

The principal ore-bearing minerals noted were chalcopyrite, with some arsenical iron and pyrrhotite. The deposition of the ore is irregular and a definite idea of its extent is therefore hard to form. A sample from one big open-cut, and excluding some stringers of obviously higher grade material, ran as follows: Gold, trace; silver, 2.6 oz. to the ton; copper, 0.7 per cent.

The presence of arsenopyrite is to be noted in view of some remarks which will be made in this connection later on.

Mammoth Group.

This property is located on the east side of Sumallo creek, about 2 miles above its junction with the Skagit river. It is owned by W. H. Robinson, of Hope.

The formation resembles greatly that obtaining at the *Diamond* group, already described; that is, altered limestone, now very siliceous. This rock, according to Cairnes, lies in a belt about 50 feet wide. Mineralized zones occur along this belt, on which some open-cutting has been done, and also one tunnel driven a few feet into the hill. These workings are about 800 feet above the valley, on the east slope of the mountain. A sample taken across 6 feet, along the side of the short tunnel from the face out, ran as follows: Gold, trace; silver, 1.2 oz. to the ton; platinum, *nil;* nickel, trace.

The next 6 feet, from entrance of tunnel along adjoining open-cut, ran as follows: Gold, trace; silver, 3.8 oz. to the ton; nickel, trace. This last material was irony and oxidized.

At these workings and in their vicinity a number of minerals can be observed, such as actinolite, pyrolusite, strontianite, scheelite, and some nickel minerals. It is, in fact, a fertile field for the mineralogist.

Star Group.

These claims are located on the west side of the Skagit river, about west of the junction of Sumallo creek with that stream. The owners are C. H. Brown and James Yates, of Hope. At a point about 1,000 feet in elevation above the valley a narrow vein has been drifted on for about 40 feet. This vein apparently shows some continuity; but owing to the precipitous and inaccessible nature of the mountain-side it is impossible to follow the outcrop at all continuously.

A small shoot of ore has been opened up, only showing, however, in the bottom of the tunnel. It has a width at the widest point of about a foot. The ore is a heavy iron sulphide, with arsenopyrite present in it. A sample ran as follows: Gold, 0.24 oz.; silver, 3.6 oz. to the ton; arsenic, 6.4 per cent.

Defries Group.

In a southerly direction and about 10 miles down the Skagit river from 23-Mile camp, a group of claims is held by P. A. Defries, of Chilliwack, and associates. This ground was not visited. A large body of sulphide ore carrying zinc and copper values is reported.

General.

C. E. Cairnes, of the Geological Survey of Canada, has spent several seasons in the Hope area. Exhaustive reports are given by him in the Summary Report, Geological Survey of Canada, Part A, for 1920 and also for 1922. These reports deal not only with the geology of the area, but include detailed descriptions of all the mining properties visited. An engineer contemplating an inspection of this district should secure them.

Arsenic has within the last year or two become a desired metal. Early in 1923 the demand was great. At the present moment it would not appear to be so strong. However, it will probably increase again, and in the district around Hope this metal shows up oftener than is usually the case in other parts of the country. Near Hope itself is located the Ladner mine, with probably a better showing of arsenical iron than obtains with any other property in the area. This mine lies in Western Mineral Survey District (No. 6) and is described in detail in the Mines Report for 1915. Since that time the property has had very little done to it. At that time it was being developed solely for its gold and silver values and no importance was placed on the arsenic contents of the ore.

The manufacturers of railway-brass use metallic arsenic as a component with copper, tin, lead, and arsenic, no zinc being used. The recent demand, however, has received a stimulus through the new use of calcium arsenate in combating the boll-weevil pest in the cotton areas of the Southern States.

The ores of arsenic are easily reduced, and this Hope area is suggested as a place worthy of investigation in the search for ores of this type.

A. E. Raab, of Hope, reports the discovery, on the west side of the Fraser river near Haig Station, of a large dyke of rock (which would appear, from the specimens seen, to be mostly a coarse-grained horn-blende). Pyrrhotite is the principal sulphide present, carrying about 1.5 per cent. nickel. This ground was only staked late in the fall of 1923. Two samples which were handed in were assayed. One of them showed considerable chalcopyrite, the other none. The copper-carrying sample ran: Gold, 0.56 oz.; silver, 1.60 oz. to the ton; copper, 4.8 per cent.; nickel, *nil*. The other ran as follows: Gold, *nil*; silver, *nil*; nickel, 3.5 per cent.

LILLOOET MINING DIVISION.

BRIDGE RIVER SECTION.

B.C. Alluvials. The British Columbia Alluvials, located on the Horseshoe bend of Bridge river, about 15 miles from its mouth, were engaged during the year in making a river-diversion cut across the toe of the bend, and are now, it is reported, commencing mining operations in the river-bed, the seepage-water being taken care of by means of a bed-rock drain carried up-stream from the lower end of the bend. The management reports that this diversion lays bare 2,700 feet of the river-bed, which is being mined by means of derricks and drag-line scraper equipment. The programme for next year, it is stated, comprises the hydraulicking of the lower bench-gravels and the continuance of river-bed operations as described above. No information is to hand relative to the recovery of gold made this year.

Wayside. This property is located on the north side of Bridge river, some 2 miles above the mouth of Gun creek. The formation here is diorite similar to that of the Cadwallader Creek mines. It is, in fact, a prolongation of the same stock. One vein has here been located, on which three tunnels (Nos. 1, 2, and 3) have been driven. A sample across 20 inches in the face of No. 1 tunnel (the highest in elevation) ran 1 oz. in gold to the ton. Other samples taken from the lower workings yielded negative results. The quartz is there, but it is not apparently gold-bearing. Not enough sampling has been done to state definitely that no part of the vein below No. 1 level carried gold values, but it looks very much as if the best chance of opening up an ore-shoot would be to continue the top level where good values were obtained.

Considerable underground work has been done to the north of the vein above described, which has not yielded results.

A quantity of arsenical pyrites is said to occur in the Bridge River country, but nothing definite is known of this matter as yet. Colonel J. E. Leckie, of Vancouver, is stated to have control of this property.

Cadwallader Creek Camp.

This camp, described at length in the Annual Report for 1922, pages 125 and 126, has been almost inactive during the year.

Lorne. At this mine Arthur Noel continued development work, single-handed. His operations this year being mainly confined to prospecting in the Wedge tunnel for a continuation, underground, of the "Old Shaft Ledge" from which some high-grade ore was taken when the shaft was sunk from the surface. Where the ore was found on the surface in the "Old Shaft Ledge" there is a porphyry dyke on the hanging-wall and

Noel succeeded this year in locating this porphyry underground, and also some high-grade ore in conjunction with it. From an inspection of the ground it would appear that he now has, underground, the same vein on which the work was done above.

Noel has also, through some surface-stripping, located two veins in a new area on this property.

Pioneer. The *Pioneer* workings having been unwatered during the summer of 1923, the mine was inspected. Two veins are exposed underground, which intersect at an acute angle. This property is developed to a depth of 250 feet below the collar of the main shaft. The upper part of the mine is reached by an adit level about 100 feet below the collar of the shaft. On this main adit level one of the veins (No. 1 vein) has been stoped to the surface for a distance of about 250 feet.

The *Pioneer* mine has no ore blocked out. Everything has been stoped out down to the bottom level. While the length of the ore-shoot at the bottom is not as long as in the adit level, there are no signs of its playing out and good ore still exists in the bottom level for a considerable distance. While the ore has a width of 5 or 6 feet at certain points, the average will be somewhere about 2 feet.

Near the *Pioneer* mine the surface is very heavily covered with wash and nothing can be seen of the country-rock. High-grade float has been found, which must come from some other vein system than that worked on. To crosscut through the diorite formation, which at this point is only 300 or 400 feet wide, would appear very sound policy. All the veins of this area are found in an intrusion of diorite, about half a mile wide and 2 miles long, the *Pioneer* workings being located at the southern extremity of this formation, where it is tapering off.

Coronation. A cave at the entrance to the main adit on this property (No. 4 level) was cleaned out during the summer and access permitted to this working. Between this level and the surface the vein has been stoped out and is now practically inaccessible. According to reliable information (A. M. Bateman's Summary Report, 1912, and unpublished manuscript by C. W. Drysdale), on No. 3 level and the bottom level (No. 4) there are two ore-shoots in the vein. At the eastern end an ore-shoot with a width of about 20 inches yielded spectacular gold values, giving $60 on the plates after the specimens had been removed. The other ore-shoot was drifted on for 280 feet and was from 12 to 28 inches in width. The vein on the bottom level is strong and well defined, varying in width from 7 to 17 inches. An inspection of the No. 4 vein was impossible last summer with the time and labour available; however, a few points on it were reached. The ground above the level is stoped for a considerable distance along the vein, and, taking in conjunction with this the good values reported in the 60-foot winze, there is every reason to believe that the ore is continuing down. Briefly, this mine stopped operating when the water-level was reached and not because the ore-shoot had played out.

Countless. A number of outcrops have exposed a vein on this property which is probably that worked on the *Coronation*. The *Countless* lies between the *Coronation* and the *Pioneer*. Going over the surface, it would appear that the ground between is worth more prospecting. A long crosscut tunnel has been driven on the *Countless* from the creek-level; but the vein, where encountered, carries no values. It was not drifted on, however, to any extent, and in the event of an ore-shoot being located above, anywhere in the vicinity, this particular working might be used to great advantage.

The camp has never received the systematic development-work due it. The nearly parallel veins and the small area of vein-bearing formation to be prospected tend to render favourable the chances for finding new veins.

Pemberton Meadows Area.

Most of the prospecting which has taken place in this area has been around the head of Tenquille creek, located on the west side of the Pacific Great Eastern Railway, between Birken and Spetch. There are two ways of reaching the district; one of them by trail from the 72-Mile post on the railway up the Birkenhead river and then up Tenquille creek; the other up the Lillooet river by wagon-road for a distance of 20 miles from Pemberton Meadows and then by trail over the high summit separating the Lillooet river and Tenquille creek to the north.

These Tenquille claims have been staked in rocks lying to the east of the Coast Cachuma and bear a great resemblance to and are probably identical with the Taseko and Denton formations described in McKenzie's report on the Taseko area (Geological Survey, 1920).

Crown. This property is located on the high summit (a road) referred to [illegible] Lillooet river and upper Tenquille creek at an elevation of [illegible] feet above sea-level. The formation, in the vicinity of the workings, is [illegible] sedimentary, with considerable epidote in evidence. Besides some open-cutting, a shaft has been sunk on the principal exposure of ore for a depth of 40 feet. The ore on the surface is mainly galena. In one cut several feet of fairly solid ore is exposed. The silver values are good, about 60 oz., but the ore does not show much continuity. At the same time there is such a lot of it on the surface at one point (some of the oxidized decomposed material also running well) that it would appear that some further underground work would be in order. The work done so far consists of this 40-foot vertical shaft, with a short crosscut driven from the bottom of it, the ore being cut off by a flat gouge about half way down the shaft.

The owner of this property is Alex. McLeod, of Pemberton Meadows. The property has been under bond for a considerable period to C. G. Codman and associates, of Boston, Mass.

Gold King Group. This property is located about a mile to the east of the Crown mine and on the Tenquille slope of the same high summit referred to above. The elevation of the workings is about 6,000 feet above sea-level. The formation is schist and there are two veins exposed, which conform with it. The strike of these veins is roughly north-west and south-east. A sample taken across 9 feet in an open cut on the west vein, ran: Gold, trace; silver, 1.6 oz. to the ton; lead, *nil*; zinc, 5 per cent. Another sample across 2 feet on the same vein, in an open-cut 100 feet away, ran: Gold, 0.06 oz.; silver, 1.2 oz. to the ton; lead, *nil*; zinc, 5 per cent.

The east vein, which parallels the other only a few feet away, has not been opened up to any extent. A sample from the outcrop at one point (not an average sample) ran: Gold, 0.60 oz.; silver, 5.2 oz. to the ton; lead, *nil*; zinc, 5 per cent.

Float can be picked up along the mountain side for a considerable distance beyond where the open-cutting occurs.

The group is owned by Alex. McLeod and C. Barber, of Pemberton Meadows.

Li-li-kel Group. This ground adjoins the *Gold Hill* group on the east. There are three veins on this property. One of them is located in the prevailing schist and conforms with it. A sample taken from an open cut on this vein across 4 or 5 feet showing mineralization, ran: Gold, 0.60 oz.; silver, 1.5 oz. to the ton. Another sample from the same vein, a couple of hundred feet away, also ran: Gold, 0.60 oz.; silver, 1.5 oz. to the ton. Here the width of the vein was only a few inches. There is a little arsenopyrite in this ore, also a very small amount of zinc blende and galena. The continuity of the ore on the surface is the doubtful factor, the ore apparently occurring in lenses. More surface work is needed.

The second vein is also located in the prevailing schist and a few hundred feet to the east of the one already described, but its strike does not conform with the schist, being approximately N. 30° E. It stands nearly vertically. This vein is very small. A little galena is to be seen occasionally.

The third vein on the property is called the "Black Lead" and is located about a third of a mile to the east of the other workings. Lying under some bluffs, a narrow mineralized mass of black-looking material can be followed for several hundred feet. There is no true vein here with foot and hanging walls, the mineralization fading off into the country rock. Manganese is probably present in some quantity. The formation in the vicinity has a strike of S. 60° W. and this mineralization conforms with it.

The following samples were taken, some from float and some from exposures of the ore in-place: (1.) Gold, trace; silver, 2 oz. (2.) Gold, 0.40 oz.; silver, 1.8 oz. (3.) Gold, 0.10 oz.; silver, 1.5 oz. (4.) Gold, 0.16 oz.; silver, 1.5 oz. to the ton.

The owners of this property are Tom Lewis and associates, of Vancouver.

Silver Bell Group. This ground was located during the summer of 1927, the owners being John Arn, A. Anderson, and O. Johnson, of Pemberton Meadows. This group is considerably lower in elevation than anything already described in the area and lies in the timber on the south slope of Tenquille creek, with about these other groups. The initial assessment work has been done in a 4-foot dyke running up and down

the hill, standing about vertically. A picked sample of the ore, which seems to be mostly on one side of this dyke (in the dyke itself), ran: Gold, 0.10 oz.; silver, 3 oz. to the ton. A very little zinc and lead was to be seen.

Moffatt Group. This property is located on the north side of Tenquille creek and about opposite to the various groups already described. The elevation of the camp is 5,400 feet. Work has been done here on two veins, one a copper vein and the other zinc-lead. The prevailing formation in this vicinity is schist, with a north-west strike and steep dip to the east. The copper vein conforms with this schist. Several feet of a good grade of chalcopyrite ore is exposed in an open-cut on the surface. A 200-foot tunnel has been driven to a point below this surface showing and a 30-foot crosscut driven at the face of this tunnel. There is not much ore exposed below as yet. The owners figure, however, that the rake of the ore-shoot above is such that a very little more work underground will pick it up.

Near the camp and to the east of the copper vein a watercourse has exposed down the hillside for a considerable distance a siliceous mineralized zone in the schist, carrying some zinc and lead. When this property was visited a tunnel was being driven to reach a point under the creek where it would be possible to crosscut this zone. Owing to the water a satisfactory examination of this discovery was at the time impossible.

The owners of this property are Phil White and Geo. Moffatt, both of Vancouver.

Copper Mountain No. 1 Group.—An exposure of magnetite was examined at the very head of Tenquille creek. There is apparently quite a belt of this mineral. At some points zinc-blende can be seen in the iron. A sample from one of these places ran: Gold, *nil;* silver, *nil;* zinc, 8 per cent. The owner of this property is J. Jack, Pemberton Meadows.

CLINTON MINING DIVISION.

Watson Bar Creek Placers.—A little placer-mining is going on in this vicinity. The Government Agent at Clinton reports as follows: "The placer claims and leases on Watson Bar creek seem to go along the same way. Some have managed to get small wages and the majority are still developing."

Crow's Bar, Fraser River.—The same authority reports as follows in connection with this area: "Four bench leases were granted this year on Crow's bar, Fraser river, to James Armes, of Vancouver, and a few placer claims staked. They are after a streak of gravel along the river; but this gravel has a heavy overburden of 30 or 40 feet and it would require good water-pressure to get rid of it."

An occurrence of coal is reported in the vicinity of Canim lake.

TASEKO AREA (WHITEWATER).

The location and means of access to this area are dealt with in the Report for 1922. Since this was published a trail has been constructed over Warner pass, which affords quick access to the country from the Lillooet side during the open season.

Windfall. This property was bonded by the Whitewater Gold Fields, Limited, of Vancouver, early in 1923 and active development-work has been carried on ever since, with H. D. Cameron as manager. When the property was visited in August, 1923, several hundred feet of underground work had failed to locate any quantity of ore in-place. Subsequent to this, reports from the management would indicate that a definite vein had been located and was being prospected.

On the surface, on the south slope of Feo creek, near the workings, is located a large amount of reddish-coloured oxidized float, carrying good gold values. A Ross mill was installed here last summer and at the time of my visit was treating this material. Where this float is cleared away, near the top of the steep bank, which flattens off into a bench about 100 feet above the creek, a horizontal seam a few inches wide has been exposed, carrying high gold values. It is from this point that the high assay values quoted in the Annual Report for 1922 were obtained.

There are apparently three sets of fissuring—horizontal, longitudinal, and vertical—in the country-rock in the neighbourhood of the workings. All the development-work done last summer, it may be noted, was on one horizontal plane. The impression gained from an inspection of this ground is that there is not exposed enough ore in-place to justify all this float, and that possibly under the creek itself, or elsewhere, there may be a zone of fissuring, carrying values, that would account for it.

Last Chance Lake, Sodium Carbonate, Clinton M.D.

Goodenough Lake, Sodium Carbonate, Clinton M.D.

The country-rock is probably an altered sedimentary belonging to McKenzie's Denain formation. In the face of the tunnel, several hundred feet into the hill south from the creek, the rock, which is fine-grained and siliceous, carries a little pyrites disseminated through it. This is characteristic of the district, where the mountains in this formation are all iron-stained.

This ground is well worth prospecting thoroughly and it is to be hoped that the campaign of development-work being carried on during the winter of 1923-24 will yield encouraging results.

Province. This claim adjoins the *Windfall* group on the south. There is a tunnel on this property located a few hundred feet to the south of the *Windfall* workings. This tunnel, 200 feet long last summer, crosscuts a ridge of rock, probably altered Denain formation, which runs north and south through the two properties. This working was in August, 1923, all in country-rock, some of it showing the usual iron pyrites. The property at that time was under bond to A. B. Trites, of Fernie.

Massena Group. This property is located on Granite creek, a few miles to the north-west of the *Windfall* mine. Two or three more open-cuts were in existence than the year before. Some iron-stained oxidized material in one of them was sampled, and ran: Gold, 0.02 oz.; silver, 0.40 oz. to the ton. In another cut, where the discovery of lead carbonate had been reported, a few small nodules of this material were found in a clay seam about 12 inches wide. What little work had been done here since the previous year had failed to improve the look of things materially.

Some other ground in the area was visited. The prevalence of iron-stain, sometimes in conjunction with porphyry dykes, has had the effect of inducing some of the prospectors to stake ground which does not carry enough values to justify such action. Nevertheless, this big area of country is well worthy of further investigation. Gold and silver values are found in the Pemberton Meadow area to the south-east and at Tatlayoko lake to the north-west on the same contact, and somewhere along it a greater concentration of values may exist and a workable deposit result.

NON-METALLIC SECTION.

GYPSUM.

In the Annual Report, 1922, page 153, a summary of the occurrences in the district of gypsum and gypsite (the pulverulent variety of the mineral) are given.

During 1923 about twenty-five cars of gypsite was shipped from various points in Mineral Survey District No. 3, five cars coming from Kelly lake, near Clinton. This gypsite was used almost entirely for fertilizing purposes.

Whilst there are a great number of deposits of gypsite to be found throughout this area, the tonnage involved is not great, as a depth of 4 or 5 feet usually penetrates through the mineral into the underlying country-rock or talus.

From what information has been gathered in this office, the Falkland deposit of rock gypsum still forms the largest deposit of this mineral in the Province. Falkland is a point on the Okanagan branch of the Canadian National Railway about 50 miles east of Kamloops, and the rails will probably be laid this summer on this line, on which the grading has been completed for several years.

The Manitoba Gypsum Company owns that part of the gypsum at Falkland adjacent to the railway, and is already laying out a spur line and siding, preparatory to making shipments as soon as the opportunity offers. Chas. Mandell, of Vancouver, and associates own the adjoining ground. A 2-mile aerial tramway would connect this property with the track, although possibly a short tramway down the mountain-side and then a 2-mile truck-haul would be as effective.

It should be stated that the gypsum in this locality occurs in a belt about 100 feet in width, striking through the country from Falkland in a general northerly direction and running through, successively, the two properties above described.

According to rumour, there are other gypsum deposits within a few miles of this point, and possibly some of them may be near enough to the railway to be worth taking up.

With the demand for gypsum becoming greater at the Coast, as will probably be the case in view of the rapidly increasing use of ground gypsum as a plaster in conjunction with wood-fibre, the Falkland area should become an important producer of this mineral when railway transportation is established.

BARYTES.

This mineral constitutes the gangue in the veins opened up at the *Homestake* on Louis creek, in the Kamloops Mining Division. In the Annual Report for 1922, page 147, this property is described in some detail. There is a large tonnage of barytes available at this point.

The *Homestake* is now being developed as a silver proposition, and if the results of this work be successful and a concentrator should be built and operated the tailings would consist of ground barytes.

According to the Mines Branch at Ottawa: "Canada at present imports most of its barytes and barytes products from the United States. The German product has recently been invading the American market, causing the closing-down of some of the chemical plants. This situation will likely affect the Canadian production, since the output from the Northern Ontario mines would be to the American chemical plants, Canada possessing no lithopone nor barium chemical works."

The Canadian production and imports of barytes for the last three years are as follows:—

Production.—1920, 751 tons; 1921, 270 tons; 1922, 60 tons.

Imports.

Year.	Barium Peroxide.		Blanc Fixe and Satin White.		Barytes.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
1920	83	$40,986	2,429	$102,198	2,998	$74,314
1921	54	26,901	1,419	61,624	1,439	40,374
1922*	82	25,973	2,336	82,033	2,566	56,631

* For eleven months only.

For the first two months of 1923 the New York quotations have been: Crude barytes, $8 to $8.10 a ton; Ground No. 1, $24 to $28 a ton; Ground No. 2 (off-colour), $13 to $14 a ton.

The Fordney tariff of $4.50 a ton on ground barytes effectively prevents the shipment, at the present time, of this mineral to the United States.

BUILDING-STONE.

Buce Lake Quarry.—Work is being started on an exposure of andesite located at Buce lake, about 17 miles east of Kamloops, on the Kamloops–Vernon highway. This material has been known of in the district for years. It is a good building-stone and can be sawn into blocks. Its weathering qualities, judging by the outcrop itself, are good. The only doubtful factor is whether some of the slips to be seen in the bluff would interfere with the securing of homogeneous blocks of, say, 2 or 3 tons. There would not appear to be any very great danger of this being the case and the work now being done, of opening up a face, will soon settle the question.

The rock varies in colour, a certain part of the exposure being light grey and elsewhere having a faint purple tinge. The location of this rock is only about 3 miles by wagon-road from the junction of the main line of the Canadian Pacific Railway with the Canadian National Okanagan branch and about 600 feet in elevation above the railway.

There should be a chance here for the development of a sound industry in connection with the supplying of building-stone not only for the town of Kamloops, but for points on the Coast.

SODIUM SULPHATE.

Recent inquiries have been received relative to occurrences of sodium sulphate on or near the coast-line of British Columbia. The nearest point to the Coast where this mineral is at present found, according to the information on the subject now in this office, is on Kamloops lake, where the Hammond deposit is located. (*See* page 154, Annual Report, 1922.)

In Saskatchewan a number of deposits of this salt are being worked, and with a freight rate of only $2 or $3 a ton to tide-water the Hammond deposit should compare favourably with them, as far as getting its product to the consumer is concerned.

At Fusilier, in Saskatchewan, natural air-drying of the salt has been attempted, when a very nice clean product was produced by laying the material out on shelves exposed to the air and allowing dehydration to take place naturally. This process worked successfully but was very slow. Near Kamloops, in the heart of the Dry Belt of British Columbia, this process should be peculiarly applicable. The ground in the neighbourhood of the deposit, moreover, lends itself to such an operation.

Whilst various processes in connection with dehydration have been tried out in the Prairie country, that which would appear to be the most successful is being used at Muskiki lake and is given below, as described by L. H. Cole, of the Mines Branch of the Department of Mines at Ottawa:—

"At the Muskiki lake (Salts and Chemicals, Limited) the patent devised by Hancock and Ide has been in practice, a large plant being constructed which has been in operation since the early part of last summer. I had the opportunity of visiting this plant and to watch several trial runs, the output of one day being 30 tons of anhydrous sodium sulphate, the efficiency of the process being close to 100 per cent. The principle of the process as given in the patent specifications is as follows: Sodium chloride (crude rock salt or a mixture of sodium sulphate and chloride, or magnesium sulphate and sodium chloride) is added to the dissolved crude hydrous sodium sulphate at a certain temperature. The sodium chloride passes into solution in the liquid, with the result that the sodium sulphate is precipitated as anhydrous sodium sulphate. The impurities, such as magnesium sulphate, which are not mechanically carried down with the precipitated salt remains in solution with the sodium chloride. The precipitated crystals are then dewatered by rotary filters till only about 10 per cent. moisture remains. The material is then dried in rotary driers to less than one-half of 1 per cent. moisture, and this is the material that they are putting on the market. The sodium chloride which is in solution in the water is recovered by ordinary methods and passed through the system again until it becomes too saturated in magnesium sulphate for further use.

"I may mention that removing the water by applying direct heat has so far not been found practical, encrustation being found on the interior of the heating vessel, greatly reducing the conductivity and thus increasing the cost as well as the difficulty in removing the salt from the container."

As of interest in connection with sodium sulphate, Bulletin 717 of the U.S. Geological Survey, entitled "Sodium Sulphate, Its Sources and Uses," is mentioned.

HYDROMAGNESITE.

There have been no shipments during 1923 of this salt from any of the localities where it occurs. (*See* Annual Report, 1922.)

MAGNESIUM SULPHATE (EPSOM SALTS).

The situation with regard to this salt does not appear to have materially changed since the Annual Report for 1922 was written.

A certain amount of work was done in connection with the Basque deposit, described in last year's report, but shipments of the salt on an important scale did not materialize. A study of other occurrences of this salt in British Columbia and Washington has made it appear as not too probable that any feeding of the lakes involved by hot springs would replenish annually the deposits of salt to an important degree. To arrive at the tonnage available, boring with augers on quite an extensive scale would seem to be the safest way.

SODA.

Lillooet Soda Co., Ltd.—The principal activity with regard to this carbonate of soda salt has been in connection with the operations of the Lillooet Soda Company, Limited. The buildings of the company are all located to the west of Chasm, on the Pacific Great Eastern Railway.

Whilst a number of lakes are held by this company, the two main deposits of soda are located at Goodenough and Last Chance lakes, the former 20 miles and the latter 9 miles west of Chasm.

From boring operations carried on and surveys made by the company, the following figures in connection with the total tonnage of soda are available:—

	Tons.
Last Chance lake, crystal soda	200,000
Goodenough lake, crystal soda	17,000
Other lakes, crystal soda	7,000
Total	224,000

The management states that there is a certain renewal of soda each year owing to seepage action, this not being taken into account in the figures given above.

An analysis of soda taken in 1918 from Goodenough lake by L. Reinecke, of the Canadian Geological Survey, is given below:—

	Per Cent.
Sodium carbonate	35.54
Sodium bicarbonate	1.34
Sodium sulphate	0.14
Sodium chloride	0.02
Water	62.89
Total	99.93

A recent analysis of muddy crystals taken from Last Chance lake is given by the company as follows:—

	Per Cent.
Insoluble matter	2.40
Ferric oxide and alumina	0.28
Lime (CaO)	Trace.
Magnesia (MgO)	Trace.
Sodium carbonate (Na_2CO_3)	34.08
Sodium sulphate (Na_2SO_4)	0.62
Sodium chloride (NaCl)	0.54
Loss on gentle ignition (H_2O)	60.78
Total	98.70

When this property was visited early in the summer of 1923 construction-work was being inaugurated on a small testing plant at Last Chance lake. Below is given an extract from a letter from C. E. Cartwright, of Vancouver, president of the company, which has been since received:—

"For the last two years the company, under the supervision of Francis Silverton, has been excavating crystals at Goodenough deposit and shipping to Vancouver, where it is sold as washing-soda without any treatment, being naturally pure.

"This season arrangements were made with K. B. Gillie & Co. to install a plant to produce soda-ash at Last Chance. The first unit of this has now been installed and has been found to work with entire satisfaction. Briefly, this plant is a modification of the Grainer system (*see* 'Salt Deposits in Canada,' by Heber Cole, Geol. Survey), in which hot gases are used in place of steam. The excess moisture is removed from the resulting sludge by a centrifugal dryer and the monohydrate so obtained is further dehydrated by placing in a muffle.

"Further plans are to increase the capacity on the same lines up to 15 or 20 tons daily capacity of soda-ash, and also to install a plant for the manufacture of 5 tons of caustic soda a day. Pure limestone is available in the vicinity for this purpose. It is hoped to get this additional plant installed during the next three or four months."

It is to be noted that the Consolidated Mining and Smelting Company of Canada, Limited, uses several tons a day of soda-ash in connection with its zinc plant and constitutes a possible consumer of this material, once it is being produced.

Silica.

Quartzite Point Deposit.—One hundred tons of quartz was mined by Joe Blais, of Kamloops, from this point, which is located on the east shore of Shuswap lake, about 7 miles north of Sicamous. The quartz was shipped to the Trail smelter, where it is used in connection with the manufacture of hydrofluosilicic acid.

LILLOOET DISTRICT.

LILLOOET MINING DIVISION.

REPORT BY JOHN DUNLOP, GOLD COMMISSIONER, LILLOOET.

I have the honour to submit the office statistics of the Lillooet Mining Division for the year ended December 31st, 1923.

Free miners' certificates issued	256
Mineral claims recorded	108
Placer claims recorded	2
Placer-mining leases operating	11
Certificates of work recorded (mineral)	171
Certificates of work recorded (placer)	31
Transfers and agreements recorded	82

Revenue.

Free miners' certificates	$1,520 00
Mining receipts, general	2,682 05
Tax, Crown-granted mineral claims	660 50
Mineral tax	146 03
Total	$4,959 08

CLINTON MINING DIVISION.

REPORT BY R. A. DORRELL, GOLD COMMISSIONER, CLINTON.

I have the honour to submit the office statistics of the Clinton Mining Division for the year ended December 31st, 1923.

Free miners' certificates	83
Mineral claims recorded	223
Certificates of work	279
Placer claims recorded	14
Bench leases issued	5
Creek leases in existence	3
"Mineral Act," bills of sale, etc.	92
"Placer Act," bills of sale, etc.	27
Certificates of work (placer)	3
Certificates of improvements	3
Crown grants	3

Revenue

Free miner's certificates	$ 332 50
Mining receipts, general	1,133 25
Total	$1,465 75

YALE DISTRICT.

NICOLA MINING DIVISION.

REPORT BY W. H. BOOTHROYD, MINING RECORDER.

I have the honour to submit the office statistics of the Nicola Mining Division for the year ended December 31st, 1923.

Free miners' certificates	70
Mineral claims recorded	40
Certificates of work	65
Bills of sale	2

VERNON MINING DIVISION.

REPORT BY L. NORRIS, GOLD COMMISSIONER, VERNON.

I have the honour to submit the office statistics of the Vernon Mining Division for the year ended December 31st, 1923.

Free miners' certificates	188
Claims recorded	75
Certificates of work (mineral)	41
Certificates of work (placer)	7
Placer leases	3
Conveyances	26
Leases of Crown-granted mineral claims	2

YALE MINING DIVISION.

REPORT BY D. A. HAZELTON, MINING RECORDER.

I have the honour to submit the office statistics of the Yale Mining Division for the year ended December 31st, 1923.

Free miners' certificates (ordinary)	176
Free miners' certificates (company)	2
Free miners' certificates (special)	3
Mineral claims recorded	127
Placer claims recorded	6
Certificates of work (mineral)	168
Certificates of work (placer)	5
Placer leases in existence	10
Bills of sale recorded	39
Powers of attorney recorded	8
Filings	23
Certificates of improvements recorded	8

ASHCROFT MINING DIVISION.

REPORT BY W. C. ADAM, MINING RECORDER, ASHCROFT.

I have the honour to submit the office statistics of the Ashcroft Mining Division for the year ended December 31st, 1923.

Free miners' certificates	106
Free miners' certificates cancelled	1
Mineral claims	122
Certificates of work	64
Notices to group	4
Rerecords	8
Bills of sale	4
Powers of attorney	4
Leaves of absence	2
Leases	5
Leases disallowed	1
Leases cancelled	13
Leases extended	1
Declarations of work and expenditure on placer-mining leases	5
Transfers	1
Assignments of placer-mining leases	1

KAMLOOPS MINING DIVISION.

REPORT BY E. FISHER, GOLD COMMISSIONER.

I have the honour to submit the office statistics of the Kamloops Mining Division for the year ended December 31st, 1923.

Free miners' certificates (ordinary)	349
Free miners' certificates (special)	2
Mineral claims recorded	225
Placer claims recorded	3
Rerecords of placer claims	4
Placer leases issued	13
Certificates of work (mineral)	242
Certificates of work (placer)	8
Bills of sale recorded	40
Powers of attorney	18
Leaves of absence	1
Certificates of improvements	1
Mining receipts	$7,328.65

SOUTHERN MINERAL SURVEY DISTRICT (No. 4).

REPORT FOR YEAR 1923.

By Philip B. Freeland, Resident Mining Engineer.

The above district, comprising four Mining Divisions—Grand Forks, Greenwood, Osoyoos, and Similkameen—is situated in the extreme south centre of the Province of British Columbia.

SYNOPSIS OF MINING IN THE DISTRICT.

The larger output of mineral in the district this year was due chiefly to advanced methods of mining in the operating properties, plus the steady demand for gold, silver, and lead.

No new discoveries of probably large tonnage were made, although the development of the *Susie* group at Fairview, which may eventually be included under that category, seems to be progressing satisfactorily.

At Greenwood and Paulson an effort made to develop the older properties has met with some measure of success and several promising quartz veins have been developed.

In the Osoyoos Mining Division the prospecting, chiefly for gold-bearing arsenical pyrites has been active and outcrops of this mineral have been discovered near Hedley and on Tenas creek.

The closing-down of the Allenby Copper Company plant at Copper mountain and Allenby was a distinct disappointment after the mine, mill, and railway were practically ready for operation. The low and unstable price of copper necessitated this action, and until the price of the metal rises and shows promise of a steady future it seems unlikely that this property will again resume operations.

Placer-mining was carried on spasmodically by leaseholders on the Tulameen river and on Granite creek. On a part of the Tulameen river held by Princeton people, an effort was made to interest capital in a dredging lease, and the ground offered seems worthy of investigation.

Andy Jensen and associates, of Tulameen, continued their efforts to develop the silver-lead veins on Treasure mountain, and, according to reports, several feet of ore of a high enough grade to pay for concentration was discovered.

The prospecting of the properties on Roche river is commanding a good deal of attention and with better transportation facilities may be developed into producing mines.

The passing of some of the old-time prospectors and men interested in mines in Greenwood is mentioned with keen regret. These men, and those like them, have been the backbone of the mining industry for many years, and the prosperous times that the Boundary country has passed through, and will again, I hope, it is now realized was mainly due to their determined efforts.

Geological Surveys.

Two geological surveys have been made this year in the Similkameen Mining Division. One intensive survey of the Copper Mountain area by Dr. Victor Dolmage and a preliminary survey by Dr. C. E. Cairnes, covering an area from the headwaters of the Skagit and Roche rivers and Whipsaw creek to Princeton.

Both these surveys will be found to be of great service in different ways, the Copper Mountain detailed survey for comparative purposes, and the other as it will give a general idea of the geological conditions to those most interested in the development of mining in that section.

The preliminary geological mapping of the country by the survey is to be highly commended and fills a much-needed want.

Properties sold for Taxes.

There seems to be a misplaced fear in the minds of those who have purchased a claim in a tax sale that some one will find it out, and that this would be to the detriment of the claim and the chances of selling it. The idea that because a claim is sold for taxes it is probably worthless seems also to abide in the minds of the public. Generally speaking, both the investing public and the purchaser of the claim are wrong in this assumption, for several reasons. First of all,

Marks Placer Mine, Similkameen M.D.

Skagit River at [illegible] Valley M.D.

many of the claims sold for taxes have been held by men who were not miners or prospectors, who did a minimum amount of work and the claim was Crown-granted without having been thoroughly explored.

Secondly, the owner of a claim may not have had sufficient capital to develop it or he may not have had any intention of doing so, hoping that some one on an adjoining property might discover ore, thereby increasing the value of his holding. Frequently the owners could not afford to pay taxes any longer and the property was sold to men who understood mining and lost a chance of developing ore with the assistance of a little capital.

In other instances owners of claims have moved away and entered other lines of business which takes up all their time, and they have allowed the property to be sold to pay the taxes. Seeing that these conditions prevail, it would seem a wise course for those interested to examine any properties offered for sale for taxes before discriminating against them.

ROAD ASSISTANCE.

A considerable amount of financial assistance was given by the Government to claim-owners for clearing out trails and roads in different parts of the district. A 4-mile "cut-off" trail was built between Kelly creek and Railroad creek in the Tulameen river. This diversion eliminates several very steep grades and gives a better road into the Summit camp and a better chance to get in supplies.

The advent of automobiles into the life of a mining camp calls for extra expenditures on roads on the part of the Government. Some of the operators find it difficult to hold their employees unless there is access to outside points by car. This is just a sign of the times and one that should not be indulged, unless those making the demand are willing to pay for the extra cost.

TOTAL TONNAGE AND CONTENTS IN MINING DIVISIONS FOR 1927.

Division.	Ore.	Gold.	Silver.	Lead.	Coal.	Limestone.
	Tons.	Oz.	Oz.	Lb.	Tons.	Tons.
Grand Forks						25,419
Greenwood	917	37	226,105	161,008		
Osoyoos	44,102	10,897	942			
Similkameen					147,477	
Totals	45,019	10,934	227,047	161,008	147,477	25,419

GRAND FORKS MINING DIVISION

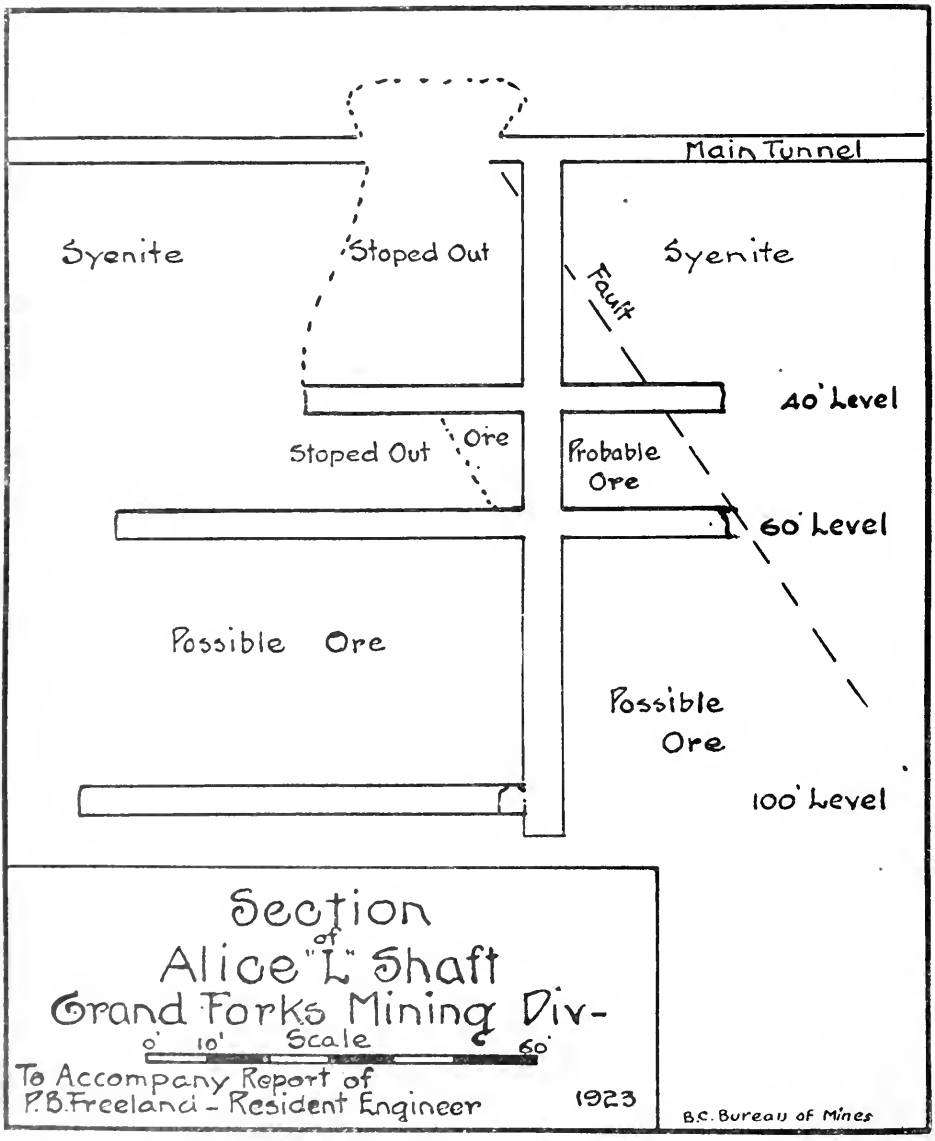
In this Mining Division activities consisted of closer prospecting and development of known areas, especially along transportation routes, with fairly satisfactory results. In the Franklin camp, one of the most interesting areas, only assessment work was done. Owing to a high United States Customs tariff no fluorspar was mined from the *Rock Candy* mine.

PAULSON.

Molly Gibson. The Molly Gibson (Burnt Basin) Mining Company continued exploration on its property, situated 4 miles south-west of Paulson. On the southern end of the property several small stringers of pyrite and pyrrhotite containing high values in gold were discovered. This discovery lends an added interest to the property, and it is hoped it will influence the company to continue the mine-development, mainly to the south or McRae Creek slope, where operations could be carried on by tunnelling less expensively. In case minable ore-bodies are discovered, railway transportation is within easy reach.

Alice L. During the summer and part of the winter a few men were employed exploring the old workings and unwatering the shaft, in the hope that a continuance, or another shoot of high grade ore, might be found. Several years ago several hundred tons of gold, copper, and lead ore, averaging $100 a ton, were shipped from the shaft. (*See* map.) Beyond the vicinity of the shaft, the vein, mainly quartz, has been badly displaced by a series of lateral and horizontal faults, striking in all directions. Along the throw of the faults appears a considerable quantity of quartz and pyrite, which contains low values in gold

and silver. These faults were followed in several directions without finding any of the higher-grade ore. There is a main fault striking in an easterly and westerly direction and dipping 57° north across the collar of the shaft that seems to control the higher-grade ore-body. It is probable that this fault formed a barrier, against which the ascending ore-bearing solutions were concentrated. The vein generally faults to the east. Future exploration might be profitably pursued to the east of the main fault on the 40-foot and 60-foot levels, and to the east at the face of the 100-foot level.



The location of the *Alice L.* claim, 4 miles from the railway at Paulson and connected by a good wagon-road, with compressor, mine equipment, and small mill near at hand, will greatly lessen the expense of operations.

The ore-minerals are gold, silver, galena, chalcopyrite, and pyrite in a quartz gangue in syenite.

Enterprise Group.—No work was done on this group during the summer months.

On the adjoining claim, Ed. Terzick, with his son and a partner from Rossland, explored a small quartz vein carrying free gold. Small shipments were made some years ago from high grade pockets in this vein. The ore-minerals are gold and pyrite in a gangue of quartz formed in fissures in the granite.

Amazon, Cascade Bonanza, and Bergen. These claims are located along the central ridge of St. Thomas mountain distant approximately 6 miles from Paulson by wagon road. Both the *Amazon* and *Cascade Bonanza* were developed and mined about twenty years ago. Several shipments of gold-silver and lead ore were made from the *Cascade Bonanza*. The vein, chiefly quartz, extends through both claims. On the *Amazon* development consists of shafts and open-cuts, exposing a vein 18 inches wide. The country-rock is syenite and syenitic porphyry overlain in small areas by volcanic tuffs including pods of limestone.

The *Bergen* claim is situated to the west of the *Amazon* at an elevation of approximately 6,000 feet. The vein, exposed by open-cuts and an inclined shaft 20 feet deep, measured 22 feet across. The ore-minerals are gold, silver, chalcopyrite, pyrrhotite, and pyrite in a gangue of quartz. The country-rocks are syenite and limestone, the quartz vein occurring close to the contact. Sample taken across the vein, 22 feet in width, assayed low in values.

The size and persistence of the veins in this vicinity and the higher grade ore obtained at depth on the *Cascade Bonanza* warrant further exploration.

Granby River

Copper No. 2. This property is owned by Pete Santure and Joe Gennas, of Grand Forks. The claim is situated on the east side of the Granby river opposite the old Franklin Camp townsite. The formations are limestone and granodiorite, with remnants of volcanic tuffs of the Franklin variety.

A crosscut tunnel has been driven across the limestone for 90 feet. As the tunnel was extended the limestone became highly silicified and mineralized with pyrite in the fractures and also finely disseminated through the rock. Low values in gold, silver, and copper were found; also some molybdenite.

The granodiorite, which occurs below the tunnel, is very slightly mineralized with chalcopyrite and bornite. It seems likely that when the contact of the limestone and granodiorite is reached a body of ore may be developed.

Leah. This claim, located close to the *Copper No. 2* in a southerly direction, is owned by John Morrell, of Grand Forks. The formations are granodiorite cut by occasional narrow dykes of alkali syenite and capped by remnants of limestone. Mineralization, constituting nodules of bornite, chalcopyrite, and pyrite, occurs in the north and south slips in the granodiorite.

Molybdenum is also present. The limestone is generally mineralized with pyrites and occasional segregations of chalcopyrite. The sedimentary forms only a small part of the rock formations, so that the ore-bodies, if present, may be looked for in the granodiorite.

Development-work consists of numerous open-cuts in the limestone and a tunnel 90 feet long in the diorite.

Seattle. This claim is situated 9½ miles from Grand Forks and three quarters of a mile west of the Granby river. Twenty years ago a company was formed by a Mr. Clark, of Grand Forks, and the property developed by tunnels and open-cuts. Several shipments of copper ore were made to the smelter, although no figures as to values are to hand.

The formations are limestone of a grey and white variety, intruded by small granite porphyry dykes and bounded on the north by granite and on the south by greenstone. The limestone is highly altered and traversed by siliceous bands, which are mineral-bearing. The width of the banding varies from a fraction of an inch to 18 inches and forms lenticular shaped ore-bodies. The mineralized area varies from 4 to 20 feet in width and 85 feet in length.

This claim was staked on what probably is an extension of a mineral zone traceable over several claims to Volcanic mountain across the Granby river and containing the same formations and minerals. No large ore-bodies have ever been discovered in this locality up to the present and exploration of the properties has been spasmodic owing to the exorbitant prices and short terms asked by the owners.

The development done in the *Scattle* claim consists of a crosscut tunnel 321 feet long, with two drifts 60 feet to the south and 120 feet to the north and an upraise to the surface 75 feet above. There are two glory-holes, 40 by 10 feet and 43 by 8 feet and approximately 15 feet deep, besides several shallow pits and trenches.

The ore-minerals are chalcopyrite, chalcocite, pyrite, and magnetite carrying gold and silver. Sorted ore from the glory-holes assayed 0.18 oz. in gold, 1.60 oz. in silver to the ton, and 7.10 per cent. copper.

Juditta Group. This group, consisting of four claims—the *Juditta*, *Robson*, *Richmond*, and *Morelli*—is owned by John Morrell and associates, of Grand Forks. It is located about 36 miles from Grand Forks and three-quarters of a mile west of the Granby river. These claims have been exploited for many years on and near the surface by the owners, resulting in small segregations of mixed-grade ores, consisting of galena, chalcopyrite, gold, silver, and pyrites.

The country-rocks consist chiefly of highly altered volcanic tuffs and cherty quartzite of the Franklin type, in contact with granite and limestone to the north, with pods of limestone occurring along the contact. The tuffs, considerably displaced by the recent intrusion of pulaskite-porphyry dykes are generally mineralized with small pyritohedrons of iron, with occasional occurrences of copper carbonate in the fractures.

On the *Juditta* claim two shafts have been sunk, 12 and 20 feet respectively, also a tunnel 20 feet long. The bottom of one of the shafts is mineralized in the fractures with galena and pyrites containing gold and silver. In the tunnel segregations of chalcopyrite, galena, and pyrite occur.

Samples of picked galena ore from the shaft assayed: Gold, 0.06 oz.; silver, 20 oz. to the ton; lead, 20 per cent. A general sample from the tunnel assayed: Gold, a trace; silver, 1 oz. to the ton; copper, 0.60 per cent.; lead, 1 per cent. The gangue is chiefly silica mixed with particles of country-rock.

Jumbo. This claim, owned by L. Neff and associates, of Grand Forks, is located about 4 miles from Grand Forks, on the west side of Granby river and on the east slope of Hardy mountain. Development consists of numerous open-cuts and shallow shafts and a tunnel 261 feet long, driven 75 feet below the surface. The country-rocks are white and grey limestone and other highly altered sediments. Small stringers, filled with calcite, pyrites, and occasional specks of chalcopyrite, cut the cover-rocks in isolated areas. Traces of gold and silver are found in the tunnel limestone.

Rock Candy Mill.—About 5,000 tons of reject material was shipped from the *Rock Candy* mill to the Trail smelter, where it was reconcentrated for its fluorite contents. This material was highly siliceous and unsuitable to the methods used at the mill (decrepitation) on the Granby river.

New Jack of Spades. Some Kelowna interests under the management of Clement Vacher have commenced the development of this property by driving a crosscut tunnel beneath the old workings. These old workings consist of open-cuts, shallow shafts, and short tunnels, all near the surface, in which nodules and stringers of carbonates of copper occur throughout the crushed formation. The country-rocks in the vicinity consist mainly of talcose schist badly displaced and crushed and overlain by a completely altered rock, containing 50 per cent. calcite and about 40 per cent. sericite, interspersed with talc, magnetite, hæmatite, ilmenite, and a black opaque mineral, probably carbonaceous.

There are large areas of this rock in this vicinity in different stages of alteration and generally highly serpentinized, with occasional lenses and specks of chromite in the serpentine. Whether this rock is an altered lava or originally a basic rock remains to be found out. The presence of chromite and in some cases platinum rather point to the latter. A sample of the ore, mostly chalcopyrite, assayed: Gold, 0.06 oz.; silver, 0.4 oz. to the ton; copper, 3.6 per cent.

Fife Limestone-quarries.—A total of 25,419 tons of lime rock was shipped from this quarry to the Trail smelter for fluxing purposes.

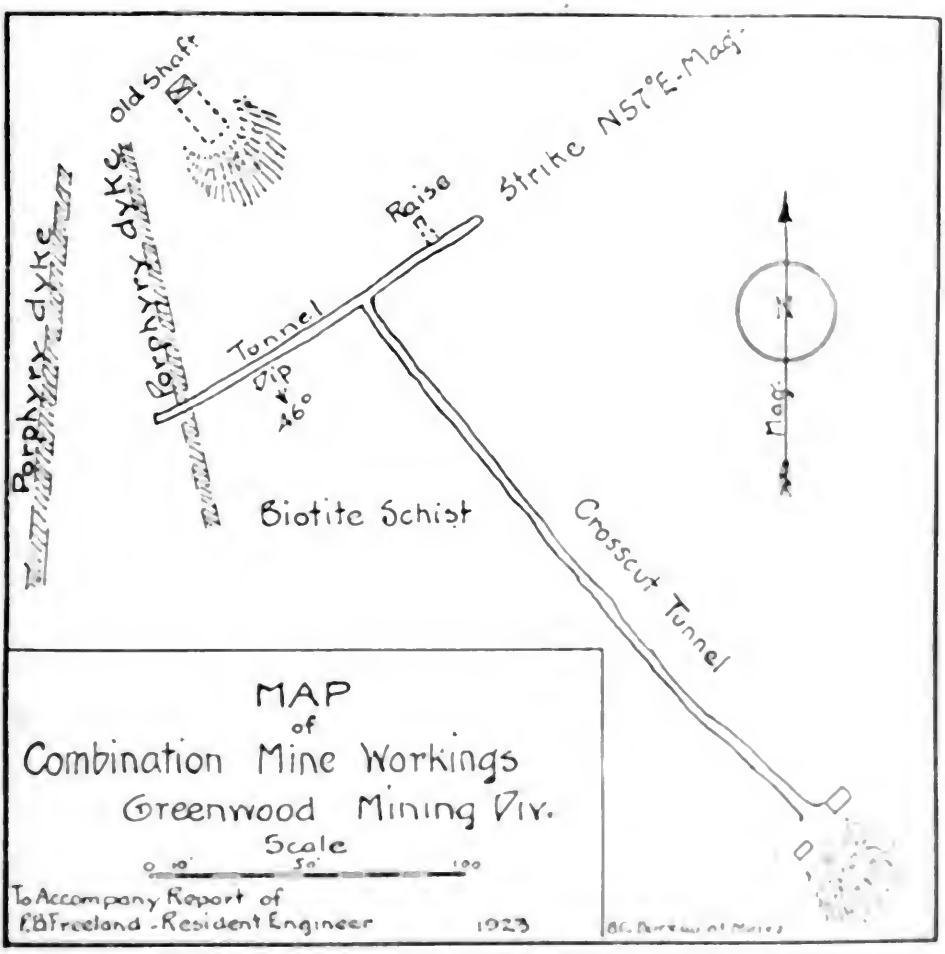
GREENWOOD MINING DIVISION.

Combination. Development-work on a crosscut tunnel, commenced in the winter of 1922, was pushed ahead and the vein discovered 212 feet from the portal. The vein in the old shaft (100 feet deep) above dipped about 70° to the south-east, with a general strike of N. 50° W. The estimated distance to be driven in the tunnel to cut the vein,

150 feet below, was 300 feet. The discovery at 212 feet was due [illegible] to a fault [illegible] luckily in the right direction. At its intersection with the crosscut the vein is [illegible] in width and contains galena, zinc-blende, pyrites, gold and free silver in a gangue of quartz. A sample from this lead assayed 2.20 oz. of gold, 304 oz. of silver to the ton, 13 per cent. lead and 12 per cent. zinc.

Drifts have been driven 44 feet to the east and 66 feet to the west, with a [illegible] of [illegible] feet from the east drift. Both these drifts showed a continuation of the vein [illegible] in size and considerably faulted, due to the intrusion of a narrow porphyry dyke.

The high values are "spotty," as is often the case in quartz veins carrying free silver. The sorted ore averages between 100 and 200 oz. of silver and 1.5 oz. of gold to the ton.



The formation in which the vein is formed is a very fine-grained dark green [illegible] intruded by narrow porphyry dykes.

Improvements consist of a blacksmith's shop and ore-sorting shed at the [illegible], a [illegible] house, a 3-drill compressor, electrically driven, and all tools necessary for mining. The Grand Forks and Greenwood highway runs within a quarter of a mile of the property and the Canadian Pacific Railway within half a mile. The owners are C. [illegible] and associates, of Spokane.

Judging from the dip of the vein above and below the tunnel and the leached appearance above and secondarily enriched ore below, it seems quite probable that by sinking on the vein more high-grade mineral may be found.

A trial shipment of 4 tons of ore was made to the Trail smelter, containing 485 oz. of silver, 7 oz. of gold, and 321 lb. lead.

Wesa and Bell. These claims are owned by Sandquist & Hebb, of Vancouver, and are situated on the north side of Lost creek, about 10 miles north-west of Greenwood. Lost creek flows into Boundary creek. A great deal of exploration was done in this area in the boom days twenty-three years ago, and since that time Sandquist and others have done yearly assessment.

The formations consist of large remnants of sedimentaries, generally highly altered and mineralized with iron pyrites and cut by dykes of alkali-syenite porphyry. On the west there is a belt of gneiss and chloritic hornblende-schists intruded by granodiorite. In the fractures of the sedimentaries and along their contact with the dykes small quartz veins have been found, containing pyrite, marcasite, and chalcopyrite, with a little gold and silver. In the gneiss larger quartz veins are found carrying gold and silver.

There has not been enough development-work to establish the camp as a producing area.

Spotted Horse. This claim was bonded from H. Duhamel, of Greenwood, by C. Bartholomew, of Spokane, and associates, and two men were put to work driving ahead on the old tunnel. Earlier in the year Duhamel opened up a quartz vein from 2 to 3 feet wide and 50 feet in length and mineralized with galena, sphalerite, chalcopyrite, pyrite, gold, and silver. The vein, though not developed, is traceable for over 1,000 feet. A tunnel 15 feet in length was driven some years ago on the lead below Duhamel's workings, and the vein as exposed measured from 1 to 14 inches in width and carried a high percentage of lead. The tunnel is being extended by the present owners. The location of the claim, 500 feet above the Canadian Pacific Railway at Greenwood, adds a great deal to its worth as a possible producer.

Samples of the ore vary considerably and at times assay high in silver. Several average samples taken contained a trace in gold, from 4 to 19 oz. of silver to the ton, from 17 to 68 per cent. in lead, and from 4 to 12 per cent. in zinc.

The lead strikes N. 78° W. (mag.) and dips from 53° to 15° to the north-east, showing a succession of minor faults from the open-cut down to the tunnel in a difference of 160 feet in elevation. The formation is granodiorite.

Sunnyside. This claim is located near Floyd's ranch and close to the Grand Forks–Greenwood wagon-road. It is being prospected by David Spooner and associates. The formations in the area where the work is being done are to a great extent altered limestone, garnetite, and epidote, in contact with gneisses and underlain with granodiorite. Mineralization occurs disseminated through and in the fractures of the limestone and is made up of pyrites and chalcopyrite in a gangue of silica.

A sample of the ore gave 0.04 oz. of gold, 3.1 oz. of silver to the ton, and 1.42 per cent. copper.

There is an altered area of limestone about 1,000 feet long and 50 to 100 feet wide, though while not entirely mineralized seems to be worthy of deeper exploration.

The Canadian Pacific Railway runs within a mile of this property, so it is well situated for transportation.

Lightning Peak Section.

West Fork. This claim is one of the old *Equinox* group. William Williams & Sons, of Edgewood, continued their lease on this property during the summer and autumn and drove ahead on the tunnel started last year. Ten tons of silver-lead was shipped to the Trail smelter. Owing to several faults and minor slips a constant difficulty was experienced in following the vein. The cost of transportation at the present time is high and does not give those interested much return for the ore shipped. It is to be hoped that some less expensive means of getting the ore to the smelter is forthcoming.

The surveyed sleigh-road from the camp to the Edgewood–Vernon wagon-road is on a good grade, and if built would probably have the effect of stimulating the prospecting of the Lightning Peak area.

Killarney.—W. Banting, of Edgewood, built a cabin on his claim and the property is in shape for development. This is a high-grade lead vein carrying about 60 oz. of silver to the ton and 60 per cent. lead.

WALLACE MOUNTAIN.

Revenge. The lessees, E. Grandburg, John Burman, and L. Clery, continued the development of this mine during the greater part of the year. About 25 tons of silver-lead ore was shipped from the upper tunnel in the early summer. A tunnel was driven 25 feet below, for 75 feet, in the hope that the ore shoot found in the upper tunnel might be developed. At the time of examination the vein had not been found, though small stringers and nodules of galena, pyrite, and zinc were dug out of the bottom of the tunnel, on what appeared to be a slip.

One of the lessees since gave out the information that a shallow shaft had been sunk in the upper tunnel and the ore "petered out" a few feet below the collar of the shaft. Further work is being done on the lower tunnel, in the hope that another ore shoot may be found.

It is the history of this camp that the ore bodies are constantly faulted, therefore the lessees seem to be justified in their search.

Standard Fraction. This claim was worked by the owner, W. Rambo, during the summer and autumn and a few tons of silver-lead ore extracted. A lease was taken on the claim a few months ago by Eric Jackson, J. Boyce, and M. Smith, and two of the lessees are developing the claim at the present time. Some high-grade ore has been taken from the veins in this mine from time to time, and, like the other veins on the mountain, it is subjected to a series of normal faults, which are often difficult to follow because there seems to be no regular system, but rather a jumble of major and minor slips one on top of the other.

There is no doubt a key to this faulting, but up to the present no one seems to have mastered it thoroughly. When this is done a great deal of useless development work will be saved. When the ore is found it is generally high grade and pays the miner for his development work.

Bounty Fraction.—This claim was leased to John McKellar and associates at Greenwood and a small amount of surface work done. Two tons of silver-lead ore was shipped to the Trail smelter.

Rambler.—A lease on this claim was given by W. H. Rambo to Chas. F. Law of Vancouver at the end of the year. No data as to development are forthcoming at the present time.

Napanee. Owing to the indisposition of the owner, G. C. Cummings, of Beaverdell, only a small amount of work was done on this claim this year. Scales of ore found in the gravel wash carried over 2.0 oz. of silver and 0.01 oz. of gold to the ton and 23 per cent. lead. These values are very attractive and further development work is looked forward to with interest.

Sally Group. The Wallace Mountain Mines, Limited, operated this group throughout the year and shipped 324 tons of silver-lead ore to the Trail smelter. During the spring and summer only a small amount of ore was shipped, owing to the extensive faulting of the vein and, in some cases, small orebodies. However a high-grade shoot of ore was discovered, on what is called the 170-foot level, later in the year and which, according to Ed. Nordman, mine superintendent, appears to be larger than usual.

Development consists of 1,086 feet of drifting, 641 feet of crosscutting, and 344 feet of upraising. Nearly all the development work was done on the *Rob Roy* claim.

WESTKETTLE RIVER.

Merlin, Jeffries, and Ohio. These claims are situated on the west slope of the hills skirting the east bank of the Westkettle river, about 2½ miles north of Rhone on the Kettle Valley Railway, and three-quarters of a mile from the river and railway. The owners are J. F. Worthington, Roy Worthington, and C. Watson of Rhone, and R. S. Stanhope, sole owner of the *Ohio*. The formations in the vicinity of the claims are diorite intruded by quartz-porphyry dykes. A quartz fissure from 6 to 18 inches in width, carrying gold, silver, and copper, has been found in the diorite. The ore minerals are chiefly pyrite, with specks of chalcopyrite and galena through the quartz.

Development consists of a shaft 16 feet deep and several open cuts on the *Merlin*, also a crosscut driven in 1923 to tap the vein 12 feet below the bottom of the shaft. The distance driven on this tunnel is not to hand.

On the *Ohio* a shaft was sunk about 40 feet deep and a crosscut tunnel driven 106 feet to cut the vein below the shaft. This tunnel has not reached the vein. The general strike of the vein is north and south, with a dip of 84° to the west. The claims are well situated for transportation.

Inyo and Ackworth.

The owners of these claims, F. O. Evans and C. H. Kingsett, of Beaverdell, put in several open-cuts and trenches, developing two leads about 5 feet apart over a distance of approximately 500 feet. In one open-cut 80 feet long the veins measured 18 and 14 inches respectively and contain pyrites and galena carrying gold and silver. The entire width of the lead, 5 feet, was broken and stained with iron oxides and lead carbonates. It seems probable that the two veins will join at a depth.

A sample of ore from this open-cut assayed 0.16 oz. of gold, 15.4 oz. of silver to the ton, and 50.6 per cent. lead. A sample of second-class ore assayed 0.12 oz. of gold, 10.1 oz. of silver to the ton, and 25.1 per cent. lead. A sample of the ore in-place over 18 inches assayed 0.12 oz. of gold, 8.7 oz. of silver to the ton, and 12.7 per cent. lead.

These values are not quite high enough to pay for mining and shipping the ore direct to the smelter, but they are good enough to warrant further exploration, and if the veins join at depth sufficient ore might be developed to justify the installation of a small reduction plant.

The claims are well located between Beaverdell and Carmi, 1 mile above the Kettle Valley Railway. The formation is quartz diorite.

Win the War and U.S.

These claims, owned by Mose Burns, of Beaverdell, are situated about 10 miles by trail from Beaverdell, on the Kettle Valley Railway, and nearly due east of that point. Assessment-work has been done regularly since 1903 and a great many open-cuts, shallow shafts, and tunnels put in. The country-rock is metamorphosed limestone, argillites, and diorite, probably of the Wallace group; this has been intruded by granitic dykes of the aplite variety which have injected a considerable amount of quartz into the limestones and argillites. There are other dark basic dykes cutting the sedimentaries near the ore-bodies. The granitic dykes are thought by Reinecke to be offshoots of the quartz diorite which outcrops below the workings.

The ore is nearly always found in the quartz veins near the porphyritic dykes and occurs as pyrrhotite, chalcopyrite, and pyrite, generally in stringers, small lenses, and finely disseminated through the altered sediments. In one shaft about 25 feet deep the quartz in contact with an aplite dyke was well mineralized with molybdenite. Samples taken from several veins gave a trace of gold and silver and 0.70 per cent. copper. No doubt samples taken from the small stringers would carry higher values, but these are not representative and could not be profitably mined.

The formations appear to be excellent for the deposition of copper ores, but up to the present time the mineralized area is not sufficiently developed to warrant capital interest.

Bell.

The operation on this mine continued steadily throughout the year under the superintendency of the owners, Duncan McIntosh and Pat Crane, of Beaverdell. Four hundred and seventy-one tons of silver-lead ore was shipped to the Trail smelter. At the end of December another car-load of ore estimated at 40 tons was shipped. This amount is not included in the year's tonnage.

Nodaway.—This property, situated on Wallace mountain, Beaverdell, is one of the *Sally* group of claims, and was leased from them by Ludlow & Co., of Beaverdell. A total of 7 tons of silver-lead ore was shipped direct to the Trail smelter.

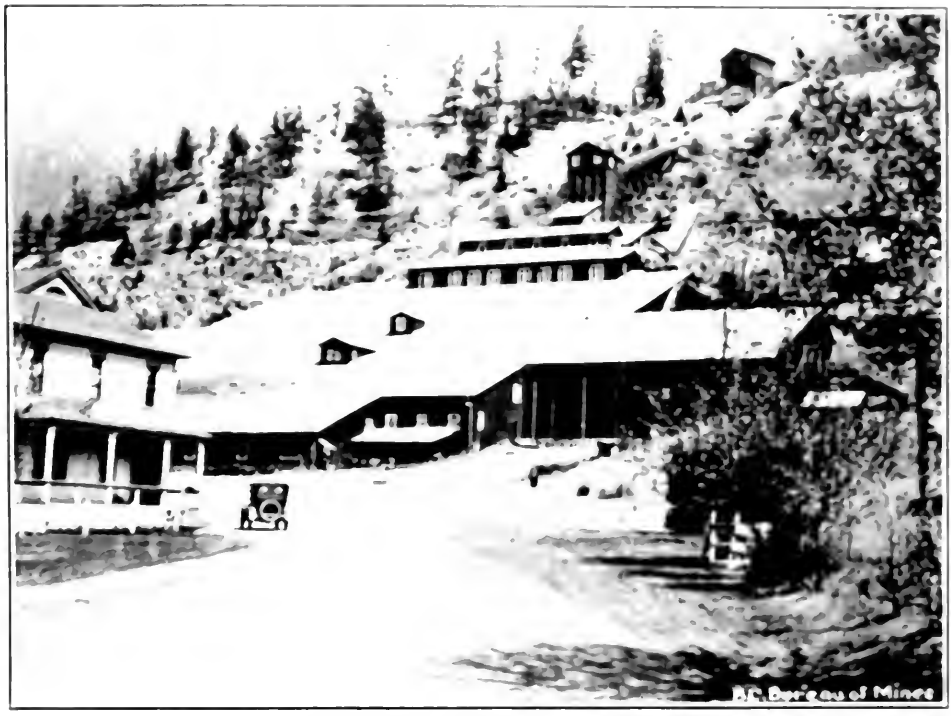
James Creek Section.

Donkey.—This claim, owned by E. Williamson, is one of a group on James creek, about 5 miles up the main Kettle river from Rock creek, on the west side. A small shipment of 1.30 tons of silver-lead ore was made to the smelter.

Greenwood Section.

Crescent.—This claim was worked part of the year by W. A. Thompson, of Greenwood, and 3 tons of silver, gold, and lead ore shipped. Work has been suspended pending the installation of a small air-compressor.

Preston.—E. A. Wanke made a small shipment of 1 ton of silver-lead-gold ore from this claim to the smelter.



Nickel Plate Mill, Hedley, Osoyoos M.D.

Prospector's Arrastra, Osoyoos M.D.

OSOYOOS MINING DIVISION.

FAIRVIEW CAMP.

Susie Group.

The development of this group of claims, situated north of Fairview, by the Fairview Mining Company continued during the year. About 700 feet of drifting on the lead was done both north and south of the inclined shaft (200 feet deep) and a crosscut nearly 1,000 feet from the south drift towards the *Federal* claim. At the present time a diamond-drill has been set up at the end of the crosscut and lateral holes drilled. The results of the drilling are not to hand.

The reason for this crosscutting and drilling is that a fault was encountered at the end of the south drift and has supposedly thrown the vein to the west into the *Federal* claim. The outcrop of a vein on the *Federal* claim of about the same width (20 feet) is made up of the same minerals and gangue, which warrants this theory. A daily average of ten men was employed under the superintendency of Geo. A. Rember.

Morning Star, Black Diamond, and Silver Crown.

These claims situated about 1½ miles north-west of Fairview, are owned by Steve Mangott and Dan McEachern, of Keremeos, and L. W. Shatford and the Shatford Estate. Development consisting of shafts, open-cuts, and tunnels was done many years ago by Steve Mangott and associates. The claims were staked under the old mining law and are 600 by 1,500 feet in size. Unfortunately, at the time of examination, the shafts were full of water and many of the open-cuts caved in, so that the veins underground were generally inaccessable for sampling purposes. There are two veins striking in a north-westerly direction, varying from 2 to 20 feet in width, approximately 300 feet apart and traceable for about 1,500 feet, with a nearly vertical dip. One shaft on the *Morning Star*, said to be about 320 feet deep, showed the persistence of the vein to that depth.

A sample taken by Mr. Mangott over 16 feet at the 100-foot level assayed $12 in gold, silver, and lead. A mill-run was made by S. Mangott, from which some bullion and concentrates was recovered. Most of this ore was taken from near the surface.

On the *Black Diamond* a shaft has been sunk about 40 feet on a quartz lead 3 feet wide and striking in a northerly and southerly direction. A sample of the vein from near the collar of the shaft assayed: Gold, 0.34 oz.; silver, 3 oz. to the ton. There are a few specks of galena present in some of this quartz.

A crosscut tunnel driven 265 feet cut the vein, measuring from 3 to 5 feet, 70 feet from the portal, on the *Silver Crown* claim. Drifts were driven 25 and 35 feet on the vein each way, a winze sunk 40 feet, and an upraise 20 feet in the ore. The mineralization in this quartz vein was very similar to that in the *Morning Star*, being characterized by pyrite, sphalerite, and occasional specks of galena carrying gold and silver. In some rock specimens free gold was plainly visible. A sample of sorted ore from this vein assayed: Gold, 0.64 oz.; silver 12 oz. to the ton; zinc, 9 per cent.

The crosscut was continued for 195 feet beyond the vein in the hope of picking up a parallel lead. About 700 feet north-west of the tunnel an open-cut 20 by 10 feet has been excavated in what appears to be a widening of the vein. Most of the quartz in this cut was fractured and showed a heavy iron-oxide stain. Small bands from 3 to 8 feet wide, mineralized with pyrites and galena, cut through the quartz. A sample of this ore carried: Gold, a trace; silver 1 oz. to the ton; lead, 1.6 per cent. The formations are schists, in which the veins are formed quartzite and alkali syenite dykes.

The history of the development of the camp, including the *Stemwinder* mine, lying in the same mineralized belt 3,000 feet to the north west, shows a certain amount of secondary enrichment and free gold on and near the surface. When the primary ores were encountered the values decreased to between $5 and $12 a ton in gold, silver, and lead, which accounts for the closing down of the mines at that time (1900-07), due to the reduction methods then practised and the lack of transportation and power.

To-day the high-power electric line passes within a few miles of the mine, the railway runs within 4 miles, and up-to-date mining and milling methods could show a very distinct saving on this class of ore, providing sufficient tonnage can be developed. The veins appear to retain their width at depth and are traceable for many thousands of feet in the surface.

White Lake Basin.—A small tonnage of coal was extracted from one of the development-tunnels on the property and shipped to Penticton. Reference to this coalfield has been made in several Reports of the Minister of Mines.

Lookout and Mountain View.

These claims, situated 2½ miles up the old *Nickel Plate* wagon-road from the Keremeos–Penticton highway and about 1¾ miles up Tenas creek, are owned by E. Mills, W. R. Dure, Chas. Cotterill, and Peter Bromley, of Keremeos.

A quartz vein varying in width from 8 to 14 inches has been formed close to the contact of a fine-grained diorite and a grey limestone, the latter being highly silicified and impregnated with iron pyrites in the region of the vein. Development-work done on a series of open-cuts and shafts exposed the vein for a depth of 40 feet and over a distance of 200 feet. Free gold was observed in some of the highly silicified limestones. Samples from the vein varied from $11.20 to $40 in gold and silver, the gold values forming the larger percentage.

During the winter a tunnel was started about 125 feet down the hill from the main shaft (25 feet deep) on the strike of the vein, N. 52° W. (mag.), and driven about 62 feet. The future success of the property lies in the possibility of either finding high-grade shipping-ore or a large body of mineral that can be profitably concentrated. On a contact of this kind that latter seems more likely. A log cabin to accommodate four men was built on the claim during the autumn.

Hedley Gold Mining Co.

This company operated the *Nickel Plate* mine and mill at Hedley during the greater part of the year, closing down only when the ice in the flumes seriously interfered with the generation of water-power. The total development for the year amounted to 300 feet of sinking, 765 feet of crosscutting, and 1,707 feet of diamond-drilling. Drifting, crosscutting, and upraising in the ore done during regular mining operations amounted to 110 feet. The total tons of ore mined and milled is estimated at 44,090, having an average grade of $7.10 a ton. The mill recovery was about 90 per cent.

Oro Fino.

This claim is situated 7 miles north-west of the old Fairview camp and 3 miles west of Meyers flat. About twenty-three years ago this property was developed and a 3-stamp mill built on Oro Fino creek, 1 mile from the mine. As far as can be ascertained, the results obtained from the small tonnage of ore milled were negative.

Development-work consists of tunnels, shallow shafts, open-cuts, and trenches, most of which are caved in and difficult to examine. In the main tunnel, probably 200 feet long, the vein, measuring 6 feet in width, was exposed. A winze had been sunk on the vein near the mouth of the tunnel at an angle of 30° and dipping in a southerly direction. The vein, which is made up chiefly of quartz, strikes in a north-easterly direction, and where uncovered showed a considerable amount of fracturing. Iron oxides were prominent in the fractures.

In a few pieces of quartz sorted from the dump small specks of gold were observed under a hand-glass. A general sample of quartz from this dump carried a trace of gold and silver. The experience of those formerly interested was that the assays taken generally varied considerably, bearing out the theory that the free gold made up the total values and is unevenly distributed throughout the vein.

In other parts of this camp small stringers of quartz are found carrying high values. These are at present being prospected by Fred. Gwatkin and partners, of Fairview.

The formations in this locality are chiefly biotite-schist intruded by granite and quartz-porphyry dykes. The main veins generally cut the formations, whilst the stringers often conform to the folding of the schist.

Olalla Camp.

Golconda.

The owner of this claim, Dan McEachern, continued driving the tunnel on the lead both ways. At the present time the total amount of development-work consists of open-cuts; an upper tunnel on the lead, 130 feet long; a crosscut tunnel 110 feet below, 400 feet long, with a drift from the crosscut on the lead 75 feet in length.

The lead in the lower tunnel is very similar to that in the upper tunnel; i.e., about 4 feet wide and containing lenses of chalcopyrite, molybdenite, and pyrite intermixed with crushed wall-rocks and carbonaceous matter. There are 2 or 3 inches of soft gouge on each wall, which is slickensided and shows a considerable amount of movement. A sample of the ore in the lower drift assayed a trace in gold, 1 oz. in silver to the ton, 7 per cent. copper, and 1 per cent. molybdenite.

Several claims are being prospected in the camp by Steve Mangott and others.

The formation on the west side of the wagon-road between Keremeos and Penticton, although to a great extent broken and displaced, shows strong indications of copper. Small lenses of nearly pure chalcopyrite are uncovered in the gravel-wash and in several of the open-cuts, and the fractures are stained with malachite.

Horn Silver. This property, situated 6 miles from Similkameen Station and within three-quarters of a mile from the wagon-road, has been referred to in several recent reports. This year the mine was examined by mining men from California who contemplate doing some development-work next year if satisfactory terms can be arranged.

Peggy Group. This group of seven claims—named the *Peggy*, *Hobo*, *Jumbo*, *Tipperary*, *War Eagle*, *Whirlwind*, and *Cyclone*—situated on the divide between Hedley creek and the Similkameen river, and 1½ miles north-west of Hedley, was developed by the owners with a little capital from Vancouver. A short tunnel and open-cut was run on the *Cyclone* and some high-grade arsenical iron pyrites carrying 3.6 oz. of gold to the ton was uncovered.

On the *Whirlwind*, lying to the south-east of the *Cyclone*, an open-cut 12 feet long and a tunnel driven 6 feet from the end of the cut developed about 5 feet of nearly solid pyrrhotite and pyrites in a gangue of highly siliceous limestone. A sample across the lead assayed 0.81 oz. of gold and 0.40 oz. of silver to the ton. The *Cyclone* and *Whirlwind* are located on the Hedley Creek slope.

On the other side of the divide several open-cuts and a short tunnel have been driven on the *Tipperary* and small lenses and stringers of arsenopyrite and pyrrhotite found. Values in gold from these workings vary from 0.16 to 0.56 oz. of gold to the ton.

The owners are Dan McKinnon, Jim Walker, and Herb. Nell, of Hedley.

The formation consists, according to Camsell, of thinly bedded limestones, quartzites, and argillites, and some tuffs and volcanic breccias, intruded by diorite in several different phases. The limestone-beds appear to dip to the west into the hill, and the theory that the ore found on the Hedley Creek slope may continue through to the Similkameen River slope may be well worth investigating. The same character of ore has been discovered on both slopes. The claims are well situated for cheap mining, power, and transportation.

SIMILKAMEEN MINING DIVISION

Tulameen River.

Christopherson Placer Claim. This placer claim, situated about 7 miles up the Tulameen river from the town of Tulameen, is owned by C. Christopherson and was leased to O. B. Gerlé and associates, of Vancouver. A combination Diesel engine and hoist were installed to operate a drag-line scraper on the bench. A grizzly, chutes, riffles, and small oil-engine were placed near the river. The operation of the scraper was found not to be entirely satisfactory owing to some large boulders causing an interference.

The material landed by the scraper was dumped over the grizzly, the fines passing down the chute to the riffles, where water was pumped in from the river. Some free gold and platinum were recovered in the riffles. The principal values, however, occurred in the black sand, a combination of magnetite and chromite, of which there was a high percentage. The probable expense of extracting the rarer metals from the black sand was considered prohibitive to profitable operation and the lease was abandoned. On bench areas where fewer boulders occurred the profitable operation of a drag-line scraper might be carried on.

John Marks Placer Claim. This claim adjoins the Christopherson lease below and has been worked by John Marks and his family for several years. The location of the claim on a bench below Olivine mountain is attractive, owing to the fact that the pyroxenite and peridotite rocks, which make up a large part of the area are platinum-bearing. Mr. Marks has diverted water from a small creek near by which gives sufficient head during part of the year to operate a nozzle.

No exact figures are obtainable as to the amount of platinum and gold saved, but it has been enough to allow him and his family to live fairly comfortably. The platinum saved appears to be rough and does not show signs of having travelled far, bearing out the theory that its origin lies in the basic rocks of Olivine mountain. Some nuggets of the gold and platinum are closely associated and appear to have come from the same source. This is not generally the

case, however. On this bench the boulders are much smaller and the operation of a drag-line scraper would probably be successful.

On the lower reaches of the Tulameen river, between Coalmont and Princeton, Claude Snowden and partners, of Princeton, prospected several benches and shallow beds with fairly good results. The idea in mind was to obtain sufficient proof of values to interest capital in the operation of the river on a large scale.

There is little doubt that the bed of the Tulameen river and adjoining benches carry values in gold and platinum from Tulameen town to Princeton (20 miles) and for a mile below. It is for those interested to find out how much a yard can be saved and whether the ground can be profitably operated by a dredge or by other mechanical means. This would entail drilling in the deeper parts and shaft-sinking where it is shallow.

The Final Report of the Mineral Resources Commission, 1920, deals with drilling tests made in the upper reaches of the river. These tests appeared to be satisfactory as far as they went.

The continued high prices of platinum (December 19th, $125 an ounce) is an added attraction to those interested. The Kettle Valley Railway follows the river from Princeton to Tulameen, therefore the transportation problem is solved.

Gypsum Group. This group of claims is owned by A. S. Black, of Princeton, and Holmes & Son, of Coalmont. There are five claims in the group—the *Gypsum*, *Nancy*, *Johnny Walker*, *Mary Ann*, and *Julia*—located on each side of the wagon-road, a mile down the Tulameen river from Granite creek. Development-work consists of numerous open-cuts, shallow pits, trenches, and short tunnels distributed over the entire group. A few tons of disintegrated gypsum were shipped some time ago to the cement plant at Princeton, but since that time nothing has been done on the claims. The depth or area of the deposit has never been proved. In some of the cuts the depth appears to be about 4 feet; in others about 10 feet.

On every claim there are indications of gypsiferous material, sometimes powdered and sometimes solid. The most promising outcrop occurs on the *Nancy* claim, below the road and close to the Kettle Valley Railway. The gypsum exposed measures about 6 feet in depth and appears to cover an area of 100 feet wide and 400 feet long. These are estimated figures as the development done is not sufficient to actually prove the amount.

The comparatively low prices offered for gypsum, about $3 to $4.50 for crushed rock, or $3.50 to $8.50 for ground, and according to grade, calls for a large deposit, nearly pure, of a good colour and close to market and transportation. This deposit has a good deal in its favour, providing the tonnage can be developed and a market found.

Davis. This claim is situated 9 miles south-east of Princeton, close to Wolf lakes, and is owned by George Allison and partners, of Princeton. The formations are diorite, intruded by quartz, porphyry, and granite-porphyry dykes. Overlying the area are volcanic tuffs and breccias. The intrusion of the dykes has caused a series of fractures in the diorite and cover-rocks. These fractures are mineralized with malachite, chalcopyrite, and pyrite, containing gold, silver, and copper in a siliceous gangue.

The intrusive rocks parallel each other at an approximate distance of 100 feet, striking in a northerly and southerly direction and dipping from 60° to 70° to the east. The fracturing follows the direction of the dykes. The width of the mineralization, where uncovered, varies from a few inches to 4 feet at the centre, tapering at each end and forming lenses.

Development-work consists of numerous open-cuts and a tunnel 20 feet long. None of these workings were extensive enough to prove the possibilities of the property. The formation, fractured by numerous dykes and showing several areas of mineralization, seems to warrant more exploration. Farther up the hill and under the capping of lava where any ore-bodies formed would be protected from erosion seems to be the best place for that exploration.

SUMMIT CAMP, TULAMEEN.

Silver Chief. Several men were employed on the development of this property during the winter of 1922 and spring of 1923 by W. B. Dornberg and associates. The tunnel, on what appears to be the main vein, was driven both ways and has now reached a total of 50 feet to the west and 54 feet to the east of the crosscut. The lead averages 4 feet across in these tunnels and contains lenses and stringers of galena and sphalerite

intermixed with iron pyrites. Some of the lenses contain nearly pure galena whilst others are mostly zinc.

The mineralization occurs nearly always close to the feldspar porphyry dyke which traverses the claim and is to be found in the upper workings. Samples taken of the galena, zinc and sorted ore assayed as follows:—

Mixed ore from east drift: Gold, 0.02 oz.; silver, 36 oz. to the ton; lead, 20 per cent.; zinc, 26 per cent.

Nearly pure galena from the west drift: Gold, 0.02 oz.; silver, 156 oz. to the ton; lead, 56 per cent.

Zinc ore from the west drift: Gold, 0.02 oz.; silver, 32 oz. to the ton; lead, 5 per cent.; zinc, 50 per cent.

Sorted ore from both drifts: Gold, a trace; silver, 78 oz. to the ton; lead, 40 per cent.; zinc, 24 per cent.

The results from these samples are interesting and should be attractive to capital.

Eureka. This claim, owned by Andy Jenson, of Tulameen, adjoins the *Walnut Fraction* and the *Silver Chief*. About 70 feet of tunnel was driven this year, which developed 4 feet of mixed lead and zinc ore. Altogether, 300 feet of tunnel has been driven on this claim, exposing lenses and stringers of galena and zinc, the zinc predominating. Dr. C. E. Cairnes, of the Geological Survey, examined, microscopically, some of the galena from this property and noticed minute specks of a white mineral which he presumed was argentite. Some tetrahedrite was also observed, as well as chalcopyrite.

GENERAL REMARKS ON SUMMIT CAMP.

Dr. Cairnes made some interesting general remarks on the camp in his 1922 Summary Report, a part of which follows:—

"The ore-deposits at the Summit camp occur at a number of widely separate points and under a variety of geological conditions. There is, however, a rather remarkable uniformity in the character of the ore-bodies at the different showings, a uniformity embracing not only their physical but their mineralogical characteristics. At each property the ore occurs in veins rarely over a few inches wide, but which may fall within a wider and more sparsely mineralized zone containing other such veins. The entire zone of mineralization constitutes the potential orebody. It may have a width of several feet, and the whole of it, in at least certain cases, constitutes concentrating-ore.

"On examination it is found that the mineralized veins are following either lines of fracture or of movement, and that, depending upon the character of the rock traversed, there is some replacement of the wall-rock by mineralizing solutions. The most abundant ore-minerals are galena and sphalerite. They commonly occur in nearly equal proportions, but either may be present almost to the exclusion of the other. The galena is commonly coarsely crystalline and assays of the pure sulphide run between 120 and 280 oz. in silver. Polished specimens of the galena show that the silver values occur as argentite minutely disseminated through the lead sulphide. No argentite or other silver mineral was observed in the sphalerite."

He goes on to say that the ore is regarded as being derived either from the great body of Eagle granodiorite to the east of Treasure mountain or from the smaller bodies of quartz-diorite occurring near the main divide at the head of Amberly creek and Sutter creek and also near the headwaters of Dewdney creek on the western slope of the divide. The gangue is commonly composed of quartz and calcite, but ankerite and stilbite have been observed.

Dr. Cairnes deals with several other properties and the general geology of the district in his 1922 Summary Report, which those interested in the camp would do well to read.

Princeton Mining and Development Co. This company continued the development of its property 4 miles east of Princeton, in a small way during the year. The lower tunnel has been driven about 623 feet, with crosscuts from the tunnel 62, 48, 24, 43 and 100 feet respectively. The crosscuts were driven in search of the orebody found to the east of the first cut driven 252 feet from the portal of the tunnel and displaced by a fault. The lower tunnel encountered a quartz-porphyry dyke 95 feet from the mouth and has been driven ahead in this dyke for about 115 feet. An upper tunnel has been driven on the vein for 112 feet at an elevation of 102 feet above the lower tunnel. An upraise 200 feet long, connecting the two tunnels, has also been put in.

At the end of the year a 400-foot railway spur extension was being constructed, and an ore-bin of 250-ton capacity, a crusher of 75-ton capacity, and a stationary steam-engine to furnish power for driving the crusher were being installed.

The formation in the lower tunnel is diorite and in the upper tunnel andesite, both rocks being intruded by a pink quartz-porphyry dyke. The ore-deposits occur as fissures and are made up of chalcopyrite, pyrite, tetrahedrite, gold, and silver in a gangue of quartz and crushed country-rock.

Samples taken from the face of No. 2 (upper tunnel) varied from 6 per cent. copper and 2 oz. in silver to as high as 20 per cent. copper and 65 oz. of silver and 0.09 oz. of gold to the ton. The higher results were obtained from an increased percentage of tetrahedrite in the ore.

The vein in No. 2 tunnel varies from 4 to 6 feet in width and contains lenses carrying copper sulphides and carbonates from 3 to 20 inches in width. The gangue appears to have specks of chalcopyrite disseminated throughout it. This vein is also exposed in the upraise to 30 feet below the floor of No. 2 tunnel and shows a continuation of the ore for that depth.

Above No. 2 tunnel some open-cuts have been excavated, developing copper carbonates in the fractures of the rock. The upraise connecting the two tunnels reached the andesite or No. 2 formation about 80 feet above the lower tunnel. It is therefore reasonable to expect a continuation of the ore found in No. 2 tunnel for that distance below.

A quartz-porphyry dyke cuts across the strike of the vein at about 45° and appears to be about 60 to 70 feet in width on the surface. As this dyke is a much younger rock than those in which the vein was formed, it is probable that no ore will be found until this dyke is crossed.

The continuation of the andesite is traceable on the surface for several hundred feet beyond the dyke, with a certain amount of copper carbonates in the fractures of the rocks, probably derived from a continuation of the mineralized zone.

The strike of the vein is nearly north and south, with a slight dip to the west. A barometric elevation gives 1,100 feet of practically unexplored ground above No. 2 tunnel, showing indications of copper along the strike of the vein.

A programme of development for driving No. 2 tunnel ahead and the opening-up of an intermediate tunnel at a point about 80 feet below No. 2 is a sound one. The projection of the lower tunnel should not be considered until a large body of ore is developed above.

Princeton Coal and Land Co.

About 16,645 tons of coal was mined from this property at Princeton, most of the coal coming from No. 1 mine, which is rapidly being worked out and in the course of another six months it will be closed. No. 2 mine is being developed and the slope driven as rapidly as the market will justify. The slopes on No. 2 are about 1,000 feet deep on the dip of the seam.

In November prospecting-work was commenced on Findlay creek, about 6 miles in a south-westerly direction from Princeton. This prospect is developing satisfactorily and an adit being driven in the seam has reached a distance of 100 feet. The seam is approximately 40 feet thick of good hard coal. Until better facilities are arranged for, the product from this development is being hauled to Princeton by team.

Bentonite.—During the year H. S. Spence, of the Mines Department of Ottawa, inspected the bentonite-deposits on the company's property at Princeton. Bentonite is a clay with useful and peculiar properties, a considerable percentage of the silica being soluable in water, but at the present time is very little known in the commercial world. Some of the uses this material is being put to are as follows: A filler for rubber goods, an adulterant for candy, making antiphlogistine, and an absorbent which seems to be its chief qualification.

The analysis of the Princeton deposits are: Silica (SiO_2), 71.2 per cent.; iron (Fe_2O_3), 3 per cent.; alumina (Al_2O_3), 11.8 per cent.; lime (CaO), 2.9 per cent.; magnesia (MgO), 0.5 per cent.; and combined water, 11.3 per cent.

The quality of bentonite is judged by the colour, the amount of foreign material in the clay, and the fineness of its constituents. If the silica needs grinding and cleaning it is an added expense that apparently the market will not stand at present.

The deposits at Princeton occur in the coal-measures and are generally overlain by a seam of coal. There are two outcrops, one in the railway-cut between Princeton and Allenby, and one

about a mile from Princeton, which measures 11 feet in width, with 3 feet of dissevered coal next the coal seam, and another about three-quarters of a mile north-east of No. 1 deposit.

The same material occurs in No. 2 slope on the Princeton Coal and Land Company, so that the transportation facilities are extremely good.

The Princeton Coal and Land Company is one of the few English concerns operating in the Interior at present. During the early part of 1923 Francis Glover, the mine manager, advised strong British interests to examine the property and take an option from the old company, which was done by George Stringer in August and a new company formed. Mr. Stringer is one of the partners in the Yorkshire firm of Stringer & Sons, whose coal operations are very extensive in England.

If the Princeton property, under the new directorate, proves to be a profitable undertaking, plentiful capital from the British coal-owner can probably be obtained. The wisdom of giving if possible, unstinted support to this exploitation, if English capital is desired, by our larger standard interests is not far to seek.

Coalmont Collieries, Ltd.—A production of 120,832 tons of coal was made from this company's mines near Coalmont during 1923, which is a decrease of 11,974 tons over 1922.

COPPER MOUNTAIN.

Allenby Copper Co.

The reorganization of the old Canada Copper Corporation and its ultimate absorption by the Allenby Copper Company in the Granby Company interests took place in 1922. In 1923 the Kettle Valley Railway began clearing up the tracks between Princeton and Allenby; the Allenby Copper Company put on a force of men at the mill at Allenby and also at Copper mountain preparatory to active operations. The new company discovered that the alterations needed in the old mill called for a greater outlay of money and time than was at first supposed; consequently, when the end of the year came, there still remained some minor repairs, such as chutes and launders to be constructed, and there are still several slides of loose rock to be removed from the railway track near the mine. The mine itself is in order for immediate operation.

Shortly after the first of the year 1924 the price of copper continued to decline to such an extent, and the future price of that metal seemed so uncertain, that the company decided to close down and wait until such time when at least 13½ cents a pound for copper could be relied upon for some continued time.

At the mine improvements were made as follows: A new loading-pocket was excavated on the main haulage level and connected with the main ore-pass by an upraise of 221 feet. A manway tunnel 89 feet long was driven to connect with the junction of the new and the old ore-pass to be used in case of a blockage of rock at the turn. A total of 1,224 feet of diamond-drilling was done from No. 2 level to ascertain more accurately the size of some of the ore-bodies. A manway 30 feet in length was driven to connect No. 1 and No. 2 workings.

Surface improvements constituted 2,240 feet of track from the railway terminal to the camp to operate a supply-tram, which is laid with 30-lb. steel rails and attached to a ⅝-inch cable. A signal and telephone system was also constructed in conjunction with the tram. At the railway terminal a coal-bin of about 80-ton capacity has been built. Brick chimneys were built in all the dwelling-houses at the mine and the bunk-houses renovated and the roofs tarred.

The reconstruction of the mill at Allenby called for many changes, the chief of which was the separate housing of the dry crushers. This was found necessary owing to the damage done to the generators by the dust and also the unhealthy condition created in the mill for those employed there. Some of the concrete foundations were cracked and had to be replaced by stronger. There was also a general shifting of the wet grinding machinery.

Plans have been consummated to take care of the waste slimes by means of a series of settling-ponds to be built in the ravine below the mill. The management, after a few experiments, discovered that a quicker precipitation of the fine particles in the slimes could be accomplished by the addition of about 4 lb. of lime (CaO) for every ton of original ore crushed. This will diminish the area necessary for slime-ponds and also allow the water to be used again in a comparatively shorter space of time.

One new set of rolls was added to the plant, due to the fact that the old company's mill test run showed that one set of rolls would not crush the highly siliceous pebbles sufficiently.

ROCHE RIVER SECTION.

Red Star and Anaconda.

Bonnibier & Poucl, of Princeton, owners of these claims, situated close to the Roche river, continued assessment-work on the lower crosscuts tunnel. A vein 16 feet wide was struck about 600 feet from the portal, mineralized, according to one of the owners, with chalcopyrite and pyrite. If this is one of the same veins developed 150 feet up the hill, which seems probable, a good deal of stoping-ground has been developed. No samples have been taken across the lead, so nothing can be said about the probable tonnage-grade of the ore.

Knob Hill.—John Bowman, owner of this claim, has driven a crosscut tunnel 157 feet in the schists, developing two separate veins, 4 and 6 feet wide respectively, and containing chalcopyrite, bornite, and pyrite in a quartz gangue.

Allenby Concentrator, Similkameen Mining Division.

BOUNDARY DISTRICT.

GREENWOOD MINING DIVISION.

REPORT BY P. H. MCCURRACH, GOLD COMMISSIONER, GREENWOOD.

I have the honour to submit the office statistics of the Greenwood Mining Division for the year ended December 31st, 1923.

Free miners' certificates	117
Locations (quartz)	20
Placer records	9
Certificates of work	117
Leases of reverted claims	12
Bills of sale	4
Certificates of improvements	1
Filings	17
Miscellaneous	4

GRAND FORKS MINING DIVISION.

REPORT BY CHAS. MUDGE, GOLD COMMISSIONER, GRAND FORKS.

I have the honour to submit the office statistics of the Grand Forks Mining Division for the year ended December 31st, 1923.

Free miners' certificates	78
Records of location	22
Certificates of work	62
Bills of sale	8
Filings	7
Leases of reverted claims	2

OSOYOOS MINING DIVISION.

REPORT BY E. S. CORE, ACTING GOVERNMENT AGENT, PENTICTON.

I have the honour to submit the office statistics of the Osoyoos Mining Division for the year ended December 31st, 1923.

Locations (quartz)	73
Locations (placer)	3
Certificates of work	75
Conveyances	13
Free miners' certificates issued	140
Filings	15
Forfeited claims leased	3

SIMILKAMEEN MINING DIVISION.

REPORT BY H. HUNTER, GOLD COMMISSIONER, PRINCETON.

I have the honour to submit the office statistics of the Similkameen Mining Division for the year ended December 31st, 1923.

Free miners' certificates	91
Location records	126
Certificates of work (mineral claims)	102
Bills of sale (mineral claims)	14
Record of placer claims	10
Leases (placer claims)	13
Bills of sale (placer claims)	7
Powers of attorney	10
Certificates of work (placer claims)	13
Certificates of improvements	13

EASTERN MINERAL SURVEY DISTRICT (No. 5).

REPORT BY A. G. LANGLEY, RESIDENT MINING ENGINEER.

(Reports marked * are by B. T. O'Grady, Assistant.)

District No. 5, or the Eastern Mineral Survey District, covers East Kootenay, comprised of the Golden, Windermere, and Fort Steele Mining Divisions, and West Kootenay, which includes the Ainsworth, Slocan, Slocan City, Nelson, Arrow Lake, Trail Creek, Lardeau, Trout Lake, and Revelstoke Mining Divisions. The headquarters office of the district is in the city of Revelstoke.

INTRODUCTORY REMARKS.

PRODUCTION.

This past year marks a substantial increase in the production of lead and zinc, which may be looked forward to as being maintained at such high level for some years to come; the principal reason being that for the first time the *Sullivan* mine has had the necessary equipment for the handling and treatment of the large tonnage it is capable of producing.

The new concentrator at Kimberley was completed in August and is referred to elsewhere in this report. The operation of this plant was soon reflected in an increase of lead and zinc concentrates to be treated at the smelter and refineries of the Consolidated Mining and Smelting Company at Tadanac, wherein preparation had been made in many improvements and enlargements; while, to meet future requirements, the capacity of the power plant at Bonnington falls, Kootenay river, is being increased by 60,000 horse-power.

Besides the production of the *Sullivan*, many properties in the Slocan-Ainsworth area have added their quota of high-grade silver-lead and silver-zinc ore and concentrates to the output of the district. The largest shipper next to the *Sullivan* was the *Silversmith* at Sandon, while a number of other properties on the shipping-list have substantial tonnages to their credit. In the northerly and more outlying parts of the district there have been numerous activities, but the production has been small; the *Paradise*, in the Windermere Division, being the only mine which has shipped any appreciable tonnage.

The total number of properties on the shipping-list for the year is fifty-eight.

PROSPECTING.

Prospecting during the last few years appears to hold its own and some good finds have been made, but the work has mostly been confined to old locations in the heart of the most thoroughly prospected areas; very little having been undertaken in virgin country remote from transportation facilities.

NEW WORK.

During the year a considerable amount of new work has been undertaken in various parts of the district and a number of companies have been organized. Among the more important the following may be mentioned:—

The resumption of mining operations at Rossland on a large scale and the acquisition of the famous *Le Roi No. 2* mine by the Consolidated Mining and Smelting Company. The Ruth-Hope Mining Company, Limited, of Vancouver, was incorporated and extensive development is planned.

The *Whitewater* and *Whitewater Deep* mines have been consolidated into the Whitewater Mines, Limited, a new company organized to carry on further development at these properties.

The *Utica* was acquired by Colonel H. H. Armstead, who, it is understood, is organizing a company called the Canadian Mines Merger, Limited, in order to obtain sufficient capital for mining and development work.

The *Gibson* on the South fork of Kaslo creek has been acquired by the Daybreak Mining Company and development is being proceeded with. It is reported that the *Lucky Jim* has been acquired by A. G. Larson and associates, of Spokane.

The *United* at Ainsworth has, according to recent reports, been taken over by a new company in which Spokane capital is interested and plans have been prepared for active operations.

The Stemwinder Mining Company was incorporated during the year, the intention being to build a 100-ton mill for the treatment of the *Stemwinder* ore in the Fort Steele District.

Shipments of exceptionally rich gold ore by lessers from the *I. X. L.* at Ross and stirred up a little excitement and resulted in work being undertaken at several adjoining properties.

The bonding of the *J. & L.* group on Carnes creek, north of Revelstoke, by strong American interests has aroused no little interest in this section of the district.

The above, with many other activities, point to increased progress for the coming year.

GENERAL.

Generally speaking, conditions during the year have been very satisfactory to the mine operators, there being no pronounced shortage of labour, no strikes, and a good market for the predominant metals of the district.

At the end of the year the Consolidated Mining and Smelting Company issued a new schedule of smelter rates on lead ores, by which the base rate was reduced from $8.50 to $8 a ton and the zinc penalty from 30 to 25 cents a unit.

M. F. Bancroft, of the Geological Survey, Canada, had a party in the Windermere Mining Division during the season.

In October members of the Canadian Institute of Mining and Metallurgy were attracted from far and wide to attend a meeting of the Institute at Trail, where, as guests of the Consolidated Mining and Smelting Company, they were given every opportunity to see the great metallurgical plant, the Rossland mines, and the power plant at Bonnington. Many prominent members of the profession were in attendance and some excellent papers were read.

In conclusion, the writer wishes to acknowledge the courtesies extended by mine owners and prospectors throughout the district.

EAST KOOTENAY DISTRICT.

GOLDEN MINING DIVISION.

This Division had rather a quiet season in mining activities, which have been confined principally to the operations of a few of the old time prospectors of the district.

The Alpha Mines Syndicate, after doing a considerable amount of exploratory work on the property at head of the Bobbie Burns creek, closed down early in the season.

It has been reported that in all probability the Canadian Pacific Railway will develop power for the electrification of their mountain section at Surprise rapids on the Columbia some 25 miles north of Beavermouth. If this should eventuate it should give an impetus to prospecting in the surrounding country, where a number of claims were staked in the early days.

Giant Group. This property, comprising five claims, is located at an elevation of 3,320 feet above sea-level and at a distance of 7 miles by wagon road from the railway at Spillimacheen. The camp is beautifully situated on the southerly slope of Spillimacheen mountain, overlooking the valley of the Spillimacheen river from an elevation of about 600 feet above the river and at about a mile distant. Except for a little work done by leasers, the property has been lying idle for a number of years. The last record of work done by the original owners, the Golden Giant Mines, Limited, was in 1910. This company erected a small concentrator, first using the Elmore oil process, but as this proved too expensive a dry method was tried, known as the S.S.S. process, the principle being to concentrate with air rather than with water. (Refer Minister of Mines' Report, 1909.)

The reason for this experimental work was no doubt the fact that there was insufficient water available for wet methods. There may be some truth in the remark reported to have been made by an old prospector, that "after a day's run enough lead concentrates were made to make a good-sized slap-jack." In the writer's opinion mill-construction was premature and ill-advised.

The problem which presents itself to-day in connection with this property is to determine by systematic exploration whether there is available sufficient ore of milling grade to warrant working the deposit on a large scale, in contemplation of erecting a plant near the river, where water-power for mining and milling purposes is available.

Instead of systematically prospecting the ore exposed in the bluff by trenching and crosscutting, a lot of money has been spent in the past by driving tunnels which do not give much information regarding the deposit and have not been extended far enough to prospect the ground in the most favourable localities.

The main bulk of the ore so far exposed and developed consists of galena disseminated through a gangue of barytes and in places sufficiently segregated to form bunches of high-grade lead ore. This ore-body has a strike of about S. 80° E. and dips at an angle of 65° to the south. The foot-wall appears to be a slate-schist, while a narrow band of limestone interbedded with the schist forms the hanging-wall. On either wall there has been shearing and faulting movements. This vein or ore-zone outcrops boldly along the crest of a bluff and can be walked on for over 200 feet. Pieces chipped at random from various places on the surface and over a large area invariably showed galena in barytes, but it appeared evident that not enough surface work had been done to determine average values, or whether it was of high enough grade to constitute ore, although small tonnages of good-grade ore could be mined selectively.

This deposit has been attacked by quarrying methods at a point near the base of the bluff and at the westerly end of the large outcrop. It was from here that ore was derived for the mill and the results of the work left a big open-cut extending across the width of the ore-zone with a face about 50 feet high. The width of the ore exposed is about 25 feet.

Sampling such a large deposit as this on a small scale is not only apt to be misleading and unsatisfactory, but in this particular case it was not practicable. However, to get an indication of the values which might be expected, a sample was taken across a width of 5 feet near the bottom of the open-cut and on the south side, which gave the following returns: Gold, 0.15 oz.; silver, 3.3 oz. to the ton; lead, 8.9 per cent.; zinc, 0.7 per cent.

On the gently sloping hillside at the base of the bluff three tunnels have been driven in the hanging-wall side and in the direction of the outcrop, but have not been extended far enough to throw much light on the character of the deposit.

The lowest, or No. 3 tunnel, gains a depth of 130 feet below the bottom of the open-cut, crosscutting a slate-schist formation for 310 feet, from which point a drift has been run 100 feet in the direction of the outcrop. From a point near the end of this drift a short crosscut to the south exposes a width of 15 feet of barytes. A sample taken across 9 feet at this point, carrying small values in silver, lead, and zinc, indicated that the metallic contents were insufficient to constitute ore. The level has not been extended far enough to explore the ground under the surface showing.

The No. 2 level has been driven for a distance of 90 feet at a point some 65 feet below the open-cut. This tunnel also cuts a slate formation in which a stringer of zinc ore was encountered in the bottom and a winze was sunk. It is reported that a car-load of ore was extracted and sold to the Pilot Bay smelter, the smelter assay returns on this ore being as follows: Silver, 2.5 oz. to the ton; lead, 9.6 per cent.; zinc, 35.4 per cent.

The face of the tunnel is in barytes, which appeared to be free from impurities, a sample of which gave the following analysis: Barium sulphate, 96.76 per cent.; specific gravity, 4.72 per cent. A large quantity of this grade of barytes could no doubt be developed.

The No. 1 level has been driven at the same elevation as the No. 2, but farther to the east. It crosscuts the formation for a distance of about 240 feet and lies to the east of the other two tunnels. The first 45 feet is in schist and the remainder in a silicified limestone. At a point 65 feet from the portal ore is exposed in the west side of the tunnel, having a width of about 12 feet, a sample across which ran: Silver, 2.5 oz. to the ton; lead, 12.4 per cent.; zinc, a trace.

All the camp buildings, including the mill, bunk-house, cook-house, and several cabins, are in a good state of repair.

The property appears to be one which has possibilities for a large tonnage of low-grade ore, and hence worthy of careful investigation with a view to doing further exploratory work. By application of modern metallurgical methods no difficulty should be experienced in making an entirely satisfactory recovery and separation of the metallic constituents of the ore, while the barytes might be a valuable by-product if a market could be obtained for same.

Hidden Treasure.

This property adjoins the *Giant* group to the east and was first prospected as early as 1895. At an elevation of 3,800 feet a large open-cut some 40 feet high and 30 feet deep marks the early attempts at mining a surface exposure of copper carbonates, from which, it is reported, some 20 tons of good grade ore was shipped. As far as could be ascertained, the mineralization is confined to a sheared zone along the contact

of limestone and slate. The copper and iron sulphides, primarily replacing limestone, have been converted by the processes of oxidation to malachite and azurite. Barytes freely occurs in this zinc, but did not appear to carry any copper. The direction of the shear is north-easterly, and following up the steep hillside old trenches, now filled in, mark early efforts of prospecting in this direction.

To explore the ground below the large open-cut above referred to a tunnel was driven from a point 50 feet lower down the hill; it runs under the open-cut in a direction of N. 40° E. Its total length is 120 feet, the first 80 feet of which is in limestone and the remainder in slate. Copper-stains in the limestone near the slate contact would indicate that a little cross-cutting at this point might have been advisable.

Columbia. Owned by Bert Lowe, of Spillimacheen, and G. R. Rury. The claim is located at a low altitude in the valley of the Spillimacheen and about 1½ miles west of the *Giant*. A small vein carrying chalcopyrite and iron pyrites occurs along the contact of slate and sandstone. The work, consisting of a few open cuts and a 25-foot shaft, has not been sufficient to prove the existence of an ore-body of economic importance, although what small quantity has been mined is of good grade. A sample from a small pile of sorted ore ran: Gold, 0.05 oz.; silver, 1.3 oz. to the ton; copper, 12.14 per cent.

BOBBIE BURNS BASIN.*

The Bobbie Burns basin lies at the head of a creek of the same name 3 miles north of the Bobbie Burns creek and is distant from Carbonate Landing some 27 miles by trail. This old quartz camp, where a number of claims were staked in 1891, 1896, and 1897, has been abandoned for many years, but taxes are still being paid on four Crown-granted claims alluded to below. Throughout the area staked there are numerous outcroppings of quartz more or less mineralized with iron sulphides carrying gold values. Only a small amount of development work has been done consisting chiefly of shallow trenches and open-cuts.

Bobbie Burns Group. This property consists of the *Robert E. Burns* (where most of the work was done), *Highland Mary*, *Nugget*, and *Rider* Crown-granted mineral claims, owned by John E. Askwith, of Ottawa. The *Robert E. Burns* claim was reported on by the Provincial Mineralogist in 1898. As conditions for an examination were more favourable at that time (most of the workings having caved in since) the following extract from his report is quoted:—

"A Crown-granted claim near the centre of the Bobbie Burns basin, at an elevation of 7,650 feet. . . . The country-rocks are slates and schists having a strike about north-west and south-east and dipping at a high angle. Cutting these rocks, and having a strike about north-west, is a series of quartz veins from 1 to 4 feet wide, while a cross-course series of smaller veins cuts this main series nearly at right angles. The veins are all mineralized, more or less, with cubical iron pyrites and a small quantity of galena, with occasionally some arsenical pyrites. The mineralization is not uniform, being greater in certain spots, and would appear to be greater in the cross-course veins than in the main series. A concentration of mineral usually occurs at the intersection of veins of the two series.

"On a knoll near the centre of the basin an open cut has been run for a distance of from 150 to 200 feet, N. 45° W., on a vein of the main series, exposing such vein, here about 3 feet wide, the vein-matter having been excavated to a depth of 6 to 8 feet. In this cut two or three cross-course veins come in from the sides. The veins, to the depth exposed, have been affected by the surface influences, and the iron sulphides, which evidently existed in considerable quantities, have become oxidized and partly removed, leaving the quartz in a honey-combed condition, in which it is sometimes possible to find visible gold. The surface material from this cut has in the past produced some free gold by washing, but I am of the opinion that such gold was only superficial and was entirely the result of the surface oxidation of the sulphides. In the bottom of the cut, even at a depth of 8 feet, sulphides of iron, both yellow and white, were beginning to appear, and will probably continue to be the form of mineralization in the veins as depth increases.

"The veins are strong and seem to be regular fissures, and it is exceedingly possible that, as soon as the prospectors get tired of hunting for free gold and turn their attention to the development of the veins, for the sulphides contained, such sulphides may be found in paying quantities.

"About the year 1891 a Fraser and Chalmers 5-stamp mill with 750-lb. heads was erected in the basin by the then Bobbie Burns Company. The mill is still standing and in good condition in a substantial log building on the hillside, and so situated that the wagon-road, about half a mile long, brings the ore from the 'open-cut' referred to to the level of the feeding-platform. The mill is well equipped, with a 'Tullock automatic feeder,' plates, etc.

"The tailings were run down to a small flat, where they were impounded and collected, probably for further testing. The mill was run by power supplied by a Pelton wheel, the water for which was conducted from a small stream in 8-inch iron pipes under a head of about 100 feet."

At the present time the mill building is in a precarious condition and the equipment useless from rust and decay. The operations of the stamp-mill were unsuccessful because it was found that practically all the gold values are in the sulphides below the very shallow zone of oxidation.

As the workings could not be examined and sampled without considerable work to clean them out, some time was spent by the writer in sampling a pile of about 100 tons of ore left outside the feeding-platform at the mill. This ore is chiefly quartz containing disseminated iron sulphides, with some leached and honeycombed quartz.

About 200 lb. of the ore was taken at random from different parts of the big pile, pulverized, and quartered down into two samples, which assayed: Gold, 0.30 oz.; silver, 1 oz.; and gold, 0.28 oz.; silver, 0.4 oz. to the ton respectively.

Selected ore high in iron sulphides from the same place assayed: Gold, 1.36 oz.; silver, 1.9 oz. to the ton.

A sample from some old tailings impounded below the mill (presumably the same material mentioned by the Provincial Mineralogist in 1898) assayed: Gold, 0.08 oz.; silver, 0.8 oz. to the ton.

Copper King and Copper Queen.* These claims are situated on the northern side of Bugaboo creek, about 2 miles by rough trail from a point on the old tote-road 24 miles from Spillimacheen. The *Copper King* is owned by R. McKeenan and the *Copper Queen* by H. W. Conover, both of Castledale. The claims are staked on the "middle lead," which is a vein about 10 feet wide striking diagonally up the mountain in a north-westerly direction (N. 30° W.), with dip to the north-east of about 58°. The vein, strong and well defined, apparently conforms to the bedding of the country-rocks, which are schists and slates. The vein-filling is quartz and altered country-rock, the mineralization consisting of disseminated copper sulphides with which some silver values are associated.

At an approximate elevation of 7,270 feet above sea-level, and a few hundred feet below the summit of the ridge, an open-cut shows a width of 4 feet of disseminated copper sulphides in quartz on the hanging-wall side of the vein, which is here about 10 feet wide. Thirty feet vertically below the open-cut there is a short crosscut tunnel now caved and inaccessible.

A grab sample from a small pile of ore on the dump assayed: Gold, 0.02 oz.; silver, 2.3 oz. to the ton; copper, 11.2 per cent.

Gray Eagle and Marjory.* These claims, owned by R. McKeenan and M. Achenbach, adjoin the *Copper King* and *Copper Queen* claims on the west and are staked on the "upper lead," which is parallel to and about half a mile westerly from the "middle lead." At an approximate elevation of 7,720 feet an open-cut shows from 3 to 4 feet of desseminated copper sulphides in quartz on the hanging-wall side, with some similar mineralization on the foot-wall side of a well-defined vein 8 to 10 feet wide, conforming to the strike and dip of the enclosing schists and slates. The strike is about N. 35° W., with steep dip to the north-east.

About 100 feet south-easterly from this open-cut, and at about the same elevation, another open-cut in the vein shows 4 feet of disseminated copper sulphides in quartz on the hanging-wall side.

Condor and Amelia.* These claims, owned by H. W. Conover and M. Achenbach, are staked on the "lower lead," which is nearly parallel to and about 2,000 feet easterly from the "middle lead" on the *Copper King* and *Copper Queen* claims. Exposed in the face of a bluff at about 5,800 feet elevation there is a vein 11 feet wide showing much the same characteristics and mineralization as the "upper" and "middle" leads. In this showing, however, the mineralization appears to be strongest towards the foot-wall side over a width of from 4 to 5 feet.

WINDERMERE MINING DIVISION

In the Windermere Division there has been about the usual amount of [illegible] prospects, but no startling new developments have taken place.

Paradise. This mine, the old stand-by which keeps the district [illegible] production is concerned, has had a good year and its [illegible] favourably with that of previous years. This year's work [illegible] of drifting, 157 feet of sinking, 198 feet of raising, and 1,432 feet of stoping. [illegible] to Trail totals 1,057 tons of silver-lead ore.

Work was also done at the *Nettie M.* on Toby creek, where the old workings were cleaned out and retimbered.

Phoenix Group.—It is reported that R. S. Gallop, an old timer in the valley, has interested W. H. Holland, of Fairmont Springs, in the development of his property, known as the *Phoenix* group, at the head of Gallop or South fork of Horsethief creek.

Ptarmigan. J. P. Farnham, of New York, spent a few weeks on the properties of the *Ptarmigan* mines at the head of McDonald creek, where he made a thorough investigation, after having the ice cleaned out of the tunnels and the old open-cuts dug out. Whether this will result in any further work being undertaken is not known.

Charles Walcott, of the Smithsonian Institute, spent most of the summer in the valley, during which time he was engaged in making a study of a section of the Rockies near Canal Flats, as well as other geological work in various parts of the district.

M. F. Bancroft, of the Geological Survey, had a small party in the field during the season.

Across Horsethief creek, not far from the 15 Mile post, J. McCullough and Larrabee Bros. have been working on a low-grade lead zinc deposit. It is reported that they have built a short length of road to the property and are now building a cabin near their workings.

White Cat Group. This property, owned by J. C. Pitts, of Invermere, consists of four Crown-granted claims—namely, the *Ground Floor*, *Heavenly Twins No. 1*, *Heavenly Twins No. 2*, and the *White Cat*. It is situated on Slade creek at a distance of about 24 miles from the railway. The location is an old one and, like many others in this district, has been lying idle for a number of years. Its inaccessibility during the period of its development no doubt was a discouraging factor. The structural conditions at and surrounding the property are somewhat complicated owing to the foldings and contortions of the strata, consisting of bands of slate, limestone, and quartzites.

The vein, striking south-westerly into the mountain, cuts a calcareous schist and apparently has been formed along a fault-fissure, having a dip of 70° to the south-east. It outcrops at the side of a steep snowslide gulch, the top of which is crowned by a glacier of no mean proportions. This outcrop consists of a lens of massive galena some 15 or 20 feet long, with a maximum width of 18 inches. To explore the vein at this point a tunnel was driven immediately under the showing and for 90 feet along its strike.

At the top of the tunnel the ore pinches to a small width and widens again in the foot, where it shows a width of about 8 inches. A sample taken across a width of 6 inches near the portal ran: Silver, 24.5 oz. to the ton; lead, 80.3 per cent.; zinc, 1 per cent. This ore streak gradually pinches out in a distance of about 40 feet in, from which point there is nothing more than a good wall and a streak of gouge to show the presence of a fissure. The elevation of this tunnel is 7,250 feet above sea level, or about 600 feet above the creek bottom.

Following up the steep hillside above the tunnel and along the direction of the strike of the vein, ore is exposed in an open cut which has been driven in the hillside at an elevation of about 85 feet above the tunnel and at a horizontal distance of about 15 feet beyond its face. Here large boulders of massive coarse cube galena are exposed apparently standing in place, although the ground surrounding them is loose and broken. The width of this ore measured 26 inches, a sample across which gave the following returns: Silver, 41.6 oz. to the ton; lead, 65.2 per cent.; zinc, 1.6 per cent. About 7 tons of ore was extracted while digging this cut in a depth of about 4 feet across the vein.

The installation of a light tram will be necessary to transport the ore from the workings to the trail in the creek bottom, some 600 feet below. It is understood that the property has been bonded to an Alberta company and that work will be resumed next year as soon as weather conditions permit.

Relief Group. This group, comprising the *Relief No. 1* and the *Relief No. 2*, is owned by Malcolm McCraik, of Invermere, and is situated on the southerly slope of Slade mountain, extending to the summit of the divide between Slade and Law creeks. From the base of the mountain the distance by trail to the end of the wagon-road up Slade creek is about 4 miles, making the total distance from the railway approximately 23 miles. From the creek-valley the trail to the workings leads up a steep and rugged mountain-side far above timber-line and ends 600 feet below the tunnel at which work was being done at the time of the writer's visit.

The elevation of this tunnel is 9,350 feet above sea-level, or about 3,000 feet above the creek-bottom. In 1917 a car-load of ore was extracted from the outcrop at a short distance above the tunnel. This ore, consisting of lead carbonates and galena, was lowered, a sack at a time, to the end of the trail, but owing to heavy transportation costs very little profit was made. The formation exposed along the trail consisted of schistose rocks which have been intruded by large masses of basic dyke-rock resembling a basalt.

The tunnel referred to above was being driven in a north-westerly direction in a lime-schist formation and for a point directly under the outcrop. At the time of the writer's visit it was in 36 feet and had a good showing of ore at the face, consisting of carbonates and galena Unfortunately the carbonates were frozen and when brought out to the surface thawed into a yellow mud. A sample of the galena ran: Silver, 32.4 oz. to the ton; lead, 63.3 per cent.; zinc, 6.9 per cent. The carbonates ran: Gold, 0.01 oz.; silver, 25.3 oz. to the ton; lead, 46.5 per cent.; zinc, 0.3 per cent.

The ore apparently replaces the limestone along a line of fissuring and has a strike of approximately N. 15° W. R. and M. McNeil, who were working the property under the terms of a lease, hoped to develop enough ore to warrant the erection of a light tram to the end of their rawhide trail. According to recent reports, the development did not come up to expectations and they abandoned the property.

There is another vein on the property on which work has been done in former years, but unfortunately time did not allow an examination of these workings.

Isaac. This mine is being operated by the Invermere Mines, Limited, under the management of J. J. Coughlan, Jr. Six men were employed by the company and it is intended to continue work at the mine until weather conditions get too severe, probably towards the end of December. Work will then be discontinued until the spring (when the danger from slides is over), and the ore will be rawhided and hauled when there is sufficient snow on the trail and road. Thirty tons of ore was shipped.

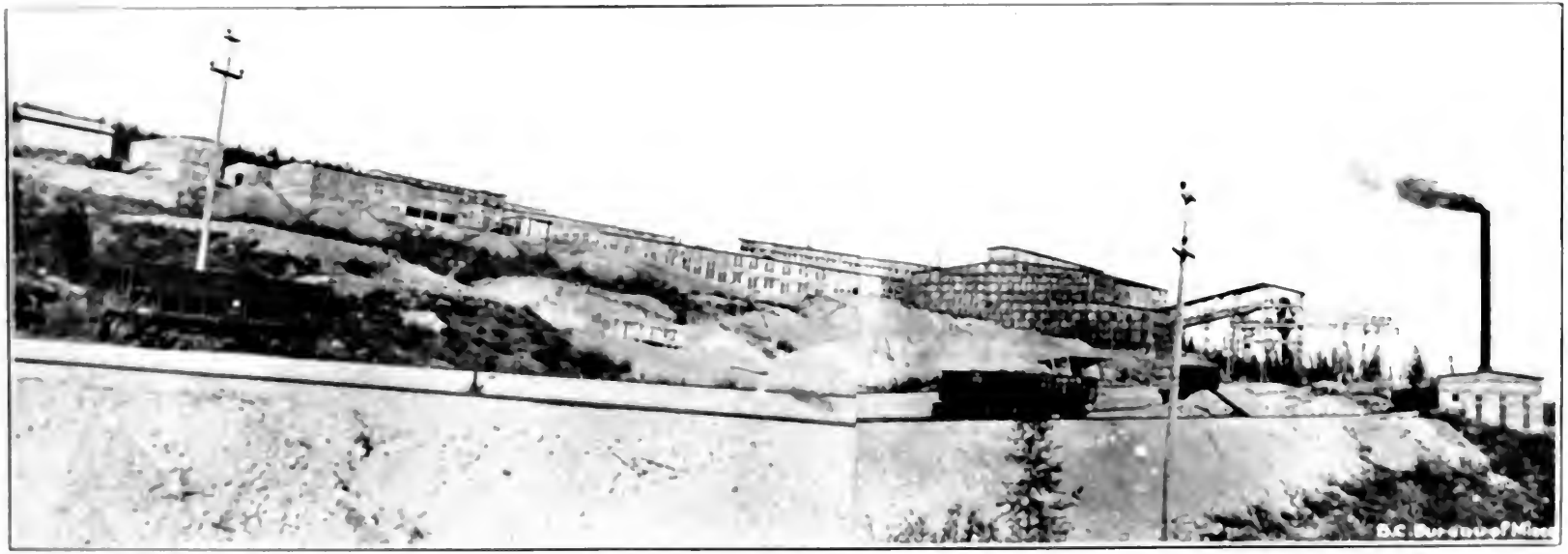
Steele Group.—This group was not operated during the year owing to lack of capital to carry on the necessary development-work. Shipments totalling 221 tons were shipped.

FORT STEELE MINING DIVISION.

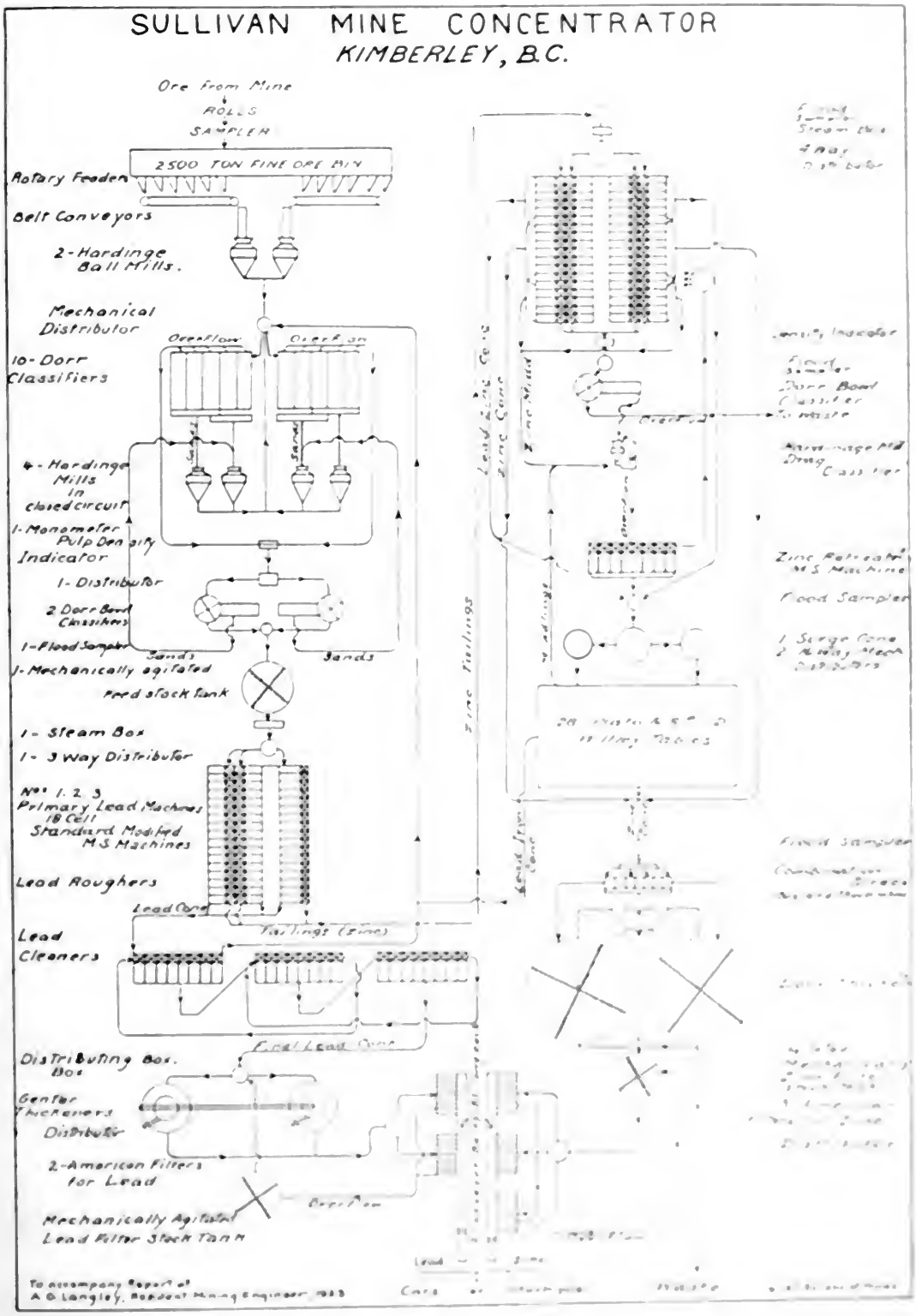
Sullivan. The immense concentrator at Kimberley, having a rated capacity of 3,000 tons a day and built by the Consolidated Mining and Smelting Company of Canada, was completed during August. This is probably one of the finest plants of its kind on the continent. Its design embodies the latest approved methods of fine grinding and treatment by the Mineral Separation oil-flotation process. The buildings, made of steel and reinforced concrete, are of excellent proportions throughout, allowing easy access to all the various types of equipment for inspection and repair, as well as room for additions where such are most likely to be needed.

The concentration of the complex lead-zinc ore of the *Sullivan* mine has occupied the attention of the company's metallurgists for a number of years, and the installation of this plant was not undertaken until the results of experimental work allowed full anticipation of all details in connection with its design that would give the best separation and recovery of the metals at the least possible cost. The satisfactory operation of the plant since power was first turned on fully demonstrates the wisdom of this policy.

When the plant was visited early in November, 1923, 2,000 tons a day was being milled, which yielded approximately 250 tons of lead concentrates averaging 68 to 70 per cent. lead and 350 tons of zinc concentrates averaging 42 to 44 per cent. zinc. A metallic content of lead and zinc of 21 per cent. is aimed at for mill-feed, all of which is crushed to a fineness of 90 per cent. minus 200-mesh.



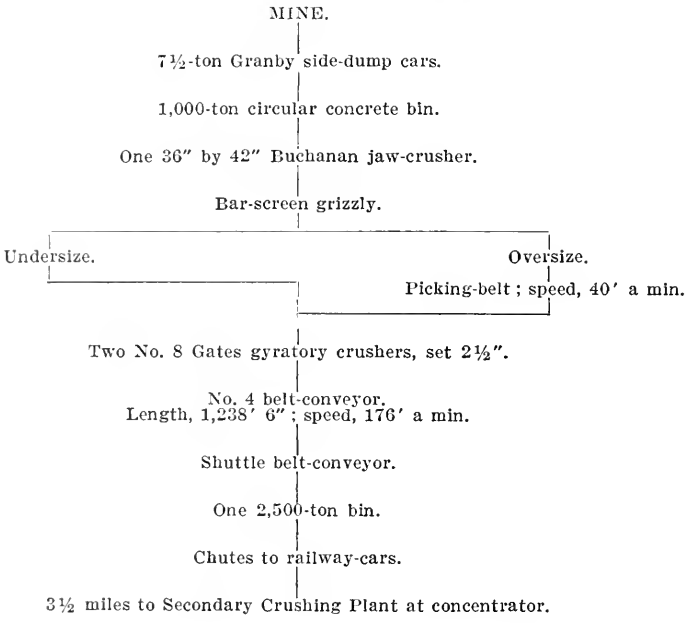
Sullivan Mine Concentrator, Kimberley, East Steele M.D.


SULLIVAN MINE CONCENTRATOR
KIMBERLEY, B.C.
Ore from Mine
ROLLS
SAMPLER
2500 TON FINE ORE BIN
Rotary Feeders
Belt Conveyors
2-Hardinge Ball Mills.
Mechanical Distributor
Overflow
Overflow
10-Dorr Classifiers
4-Hardinge Mills in closed circuit
1-Monometer Pulp Density Indicator
1-Distributor
2 Dorr Bowl Classifiers
1-Flood Sampler
Sands
Sands
1-Mechanically agitated Feed stock tank
1-Steam Box
1-3 Way Distributor
Nos 1. 2. 3 Primary Lead Machines 18 Cell Standard Modified M.S. Machines
Lead Roughers
Lead Cone
Tailings (Zinc)
Lead Cleaners
Final Lead Cone
Distributing Box.
Box
Center Thickeners
Distributor
2-American Filters for Lead
Overflow
Mechanically Agitated Lead Filter Stock Tank
Zinc Tailings
Lead Zinc Cone
Zinc Cone
Zinc Middle
Overflow
Zinc Retreated M.S. Machine
Flood Sampler
1 Surge Cone
2 Wilfley Tables
Flood Sampler
To accompany Report of A. G. Langley, Resident Mining Engineer, 1923

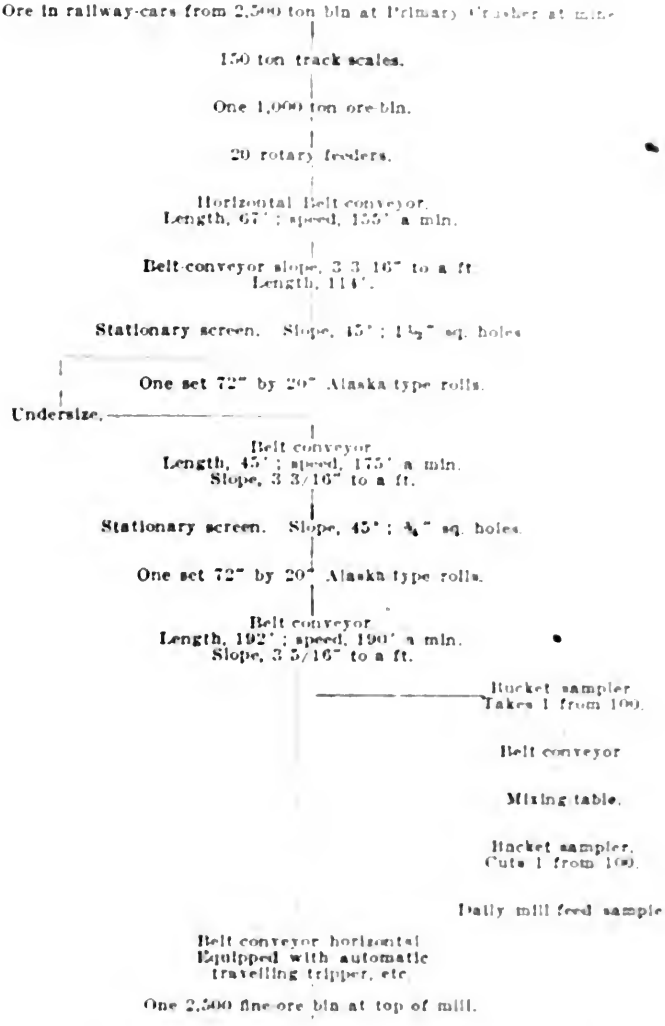
Owing to a slight shortage of power the thirty-six tables embodied in the flow-sheet were not being used. This power-shortage is only temporary and will be remedied as soon as the new power plant at Elko, now under course of construction, is completed. The accompanying flow-sheet shows the main features of the equipment.

SULLIVAN MINE.

PRIMARY CRUSHING PLANT AT PORTAL OF MINE TUNNEL.



Secondary Crushing Plant at the Concentrator.



A camp-site for the men employed at the mill has been established on the flat at the base of the hill and within a convenient distance. Here substantial houses are being erected for the higher officials and good accommodation is afforded for the married and single men.

Many improvements have been made since last year, including the completion of the bunk-houses and cottages at the lower camp, where the married and single employees of the company are provided with the usual comforts and conveniences of modern times. Near the tunnel the large primary crushing plant and bins are of pleasing proportions and at once significant of the immense flow of ore that is necessary to satisfy the new concentrator.

For some distance in from the portal of the adit tunnel known as the No. 3,000-foot level has been lined with concrete. Concrete posts replace the timber and steel I beams the caps.

The tunnel dimensions are 9 feet wide at the sills and 8 feet high.

New mine-tracks have been laid with 45-lb. rails, the gauge being 36 inches. Storage-battery locomotives are used in development-tunnels, while electric motors are used on the main haulage-ways. Voltage for their operation is supplied at 550 volts.

The 3,000-foot level is now into the hill for a distance of 11,000 feet. Development of the north ore-body is being proceeded with and preparations are well under way for mining this

immense ore-body on a commensurate scale. Its length has not yet been determined by underground workings, but sufficient work has been done to demonstrate the existence of an immense tonnage between the 3,900-foot level and the upper workings; between these the distance on the dip of the vein is about 1,500 feet, in which length the vein swells a width of 170 feet. The ore-deposit along this part of the vein consists of a massive body of iron, lead, and zinc sulphides. The grade of the ore is not uniform, but varies with different phases of mineralization.

A long crosscut is now being driven due west in the foot-wall side; from this, tunnels parallel to the strike of the vein and about 300 feet apart will be driven. From these tunnels ore-chutes will be driven at an angle of 65°, or normal to the dip of the vein. On the sill-floor mechanical shovellers will be employed to load the ore into the cars. Higher up in the stope the ore will be loaded into the chutes by means of drag-scrapers, which are now being employed in other parts of the mine. In order to support the roof of the stope, which dips at an angle of about 23° to the east, pillars 100 feet square will be left at regular intervals.

At the present time about 1,200 tons a day are being mined from the 3,900-foot level and some 800 tons from the upper workings. All told, about 600 men are employed at the mine and fifty at the concentrator.

Two Nordberg compressors having a capacity of 3,000 cubic feet of free air a minute each and driven by synchronous motors have been added to the power plant, making its total air capacity 9,000 cubic feet a minute.

Stemwinder.

This property, which is situated on Mark creek at a distance of about half a mile westerly from the *Sullivan* tunnel, was originally owned by Sir Donald Mann and the late Sir William McKenzie. It is understood that it has been acquired by the Stemwinder Mining Company, Limited, recently incorporated, and that mining and milling operations will be conducted under the management of O. C. Thompson, of Kimberley.

The workings are principally confined to a small area of ground in the creek-bottom and consist of several tunnels driven into the hill in a southerly direction at a short distance above the creek-level, also a 70-foot shaft sunk near the creek. These workings disclose the presence of a highly mineralized zone consisting principally of iron sulphides, with which are associated values in silver, lead, and zinc. The enclosing formation is quartzite, although insufficient work has been done to conclusively demonstrate the extent and nature of the deposit.

To further explore the lateral and vertical extent of the ore, diamond-drill holes were put down in recent years by the Federal Mining and Smelting Company, who had an option on the property. This work, together with the underground development, gives evidence that there is a large tonnage of probable ore, which runs sufficiently high in silver, lead, and zinc to yield a good margin of profit if concentrated.

It is understood that arrangements have been completed for the erection of a 100-ton concentrator next spring. This plant will have a flow-sheet similar in principle to that of the *Sullivan* concentrator, and it is anticipated that it will be built in the vicinity of the latter plant.

North Star.

This property is situated on the south side of Mark creek at a point almost due south of and opposite to the *Sullivan* mine. The elevation of the workings is 5,260 feet, while the upper workings of the *Sullivan* are about 4,600 feet above sea-level, and as the *Sullivan* vein strikes about north and south the two deposits may be closely related, although this has so far not been established by the development.

The property has had an interesting history, having first been opened up as early as 1895 by the North Star Mining Company, who are the present owners. At this time the ore-body is said to have consisted of a deposit of galena lying in a basin almost at the surface, and is described as being one of the largest and most compact bodies of galena ever found in the Province. After this ore was mined out exploratory work failed to prove its continuity or to locate new ore-bodies, and in 1904 the mine was reported to be worked out.

However, subsequent operations revealed the presence of large tonnages of good-grade carbonate ore around the edges of the old stopes and overlying the galena ore-body. Considerable tonnages of this ore were mined over a period of four or five years and a large bulk of it is said to have carried 22 per cent. lead and 15 oz. silver to the ton.

After the property had been lying idle for a number of years it was taken up under the terms of a lease by O. C. Thompson and associates in 1918, and from this time until 1920 over 16,000 tons of lead-carbonate ore was shipped from the dumps and shallow-surface diggings. To-day the surface workings, spreading over a large area, have the appearance of a shallow

gravel-pit, but large quantities of this dirt are said to run 4 oz. to the ton in silver and 8 per cent. lead.

There are a number of geological features pertaining to the deposit which [illegible] to account for, but the main feature is that it is shallow and apparently lies [illegible] of a quartzite foot-wall, the hanging wall having been completely eroded away and the [illegible] portions of the vein with it. (Refer to Memoir 76, Geological Survey, Canada.) The mineralization extends along the general direction of the apparent strike, which is northerly and southerly for a distance of about 600 feet and for 150 feet across the dip in an easterly direction. In places it was noticed that narrow bands of iron sulphides lie next the foot-wall and are overlain by a layer of finely crushed siliceous material, which in turn is covered by compact glacial drift extending for 15 feet to the surface. A sample taken across a width of 3 feet of the siliceous material gave the following returns: Silver, 14.1 oz. to the ton; lead, 1.6 per cent.

The main bulk of the tonnage has been mined by glory hole methods and taken out by an adit-tunnel run in the foot-wall at a depth of 60 feet below the surface, while thousands of feet of tunnelling and numerous shallow shafts have been sunk to prospect and prove the extent of the ore-bodies. Conditions would seem to warrant further exploratory work by diamond-drilling at some distance down the mountain-side. Besides a large tonnage of low grade carbonate being available, there is also a considerable tonnage of a good milling grade of sulphide ore similar in character to some of that at the *Stemwinder*. A sample taken of this ore ran: Silver, 9 oz. to the ton; lead, 12.1 per cent.; zinc, 17.9 per cent.

On the northerly end of the property a good deal of exploratory work has been done on strong showings of iron sulphides, but it is understood the values were too low to constitute ore. One shaft named the "Kellogg" is down 200 feet, but could not be examined on account of water.

The property is equipped with a Halliday aerial tram, which is in good running order. It is proposed to work the property in conjunction with the *Stemwinder*, should the contemplated concentrator at the latter property be installed.

Aurora.

This mine is situated on the west shore of Moyie lake at a point almost opposite the *St. Eugene* mine. The property comprises a group of five claims and is owned by I. R. Sanburn, of Portland, Oregon, and associates. It is situated at a distance of about 2 miles from Aldridge, on the Canadian Pacific Railway, which would probably be the shipping point if tonnage in any great quantity were developed.

The location and strike of the vein signify that it is in the same zone of fissuring as the *St. Eugene* mine on the other side of the lake; hence the deposit has attracted more attention than it probably would have done otherwise. The vein, striking about N. 75° W. and dipping 55° to the south, cuts the thinly bedded quartzites of the Aldridge formation. It has been developed by an adit-tunnel, known as the No. 2 level, which has been driven into the hillside in a westerly direction at a point about 200 feet above the lake shore.

No ore of any consequence was encountered in the first 330 feet of this drift, when it makes its appearance in the roof along a distance of about 75 feet. A raise put up on this ore follows a streak which widens to about 3 feet at a distance of 50 feet above the level, across which width a sample was taken giving the following returns: Gold, 0.02 oz.; silver, 3.7 oz. to the ton; lead, 16.3 per cent.; zinc, 31.7 per cent.

From this raise ore has been stoped along a distance of 150 feet, the highest point in the stope is about 38 feet above the top of the raise or 88 feet above the main level. There is a nice showing of ore in the face of the stope, which has a width of about 2 feet and is apparently of uniform grade. A sample taken across a width of 22 inches ran as follows: Gold, 0.02 oz., silver, 11.3 oz. to the ton; lead, 30.2 per cent.; zinc, 35.4 per cent.

The ore is a coarsely crystalline mixture of galena and zinc-blende with a quartz gangue. It is essentially a milling grade ore, although a fairly clean lead product could be obtained by hand-sorting.

At a height of 150 feet above the No. 2 level an 80 foot shaft has been sunk on a vertical vein which at the surface lies about 85 feet to the south of a point where the main vein should outcrop, and apparently runs parallel to it. The vein as exposed in the shaft is small and the ore principally zinc-blende. A sample taken in the shaft across a width of 18 inches ran as follows: Gold, trace; silver, 2.9 oz. to the ton; lead, 9.7 per cent.; zinc, 34.3 per cent. A sample of the sorted zinc-blende ran: Silver, 1.1 oz. to the ton; zinc, 57.1 per cent.

A limited amount of drifting done from the bottom of the shaft discloses pockets of ore, but no continuous ore-body of any appreciable dimensions. A winze sunk from these upper workings connects with a drift on this vein run from the end of a 20-foot crosscut from the main vein on the No. 2 level. Thus at this point the two veins are 20 feet apart and should come together some 30 feet below the level.

On the dumps at the No. 2 tunnel there was estimated to be at least 500 tons of partially oxidized fine stuff; probably the reject from sorted ore. A grab sample taken at different points from the surface of this dump ran: Gold, 0.03 oz.; silver, 5.4 oz.; lead, 13.7 per cent.; zinc, 32.8 per cent.

Other work consisted of a tunnel driven from a point about 50 feet above the lake-level and about 150 feet vertically below the No. 2 level. This tunnel could not be examined as it was caved, but is reported to be in 370 feet, the face being almost vertically under the portal of No. 2.

The owners very wisely had the principal workings cleaned out and retimbered where necessary this year, so any one visiting the property will find the mine in good shape for examination.

Guindon Group.

This property has been referred to in the Annual Report for 1917. Since it was visited on this occasion work has been confined to a lower tunnel driven into the hill from a point near the lake-shore for a distance of 400 feet in a westerly direction. It follows a small fissure in which occasional pockets of lead-zinc ore were encountered. At a point 300 feet from the portal it cuts faulted and sheared ground in which small lenses of ore were encountered; as these seem to lead off into the side of the drift, a little crosscutting at this point might be advisable. About 4 tons of ore shipped from this part of the workings yielded average values of: Silver, 7 oz. to the ton; lead, 23 per cent; zinc, 9 per cent. This level is connected with an upper level by an 80-foot shaft.

F. Guindon, of Moyie, who is one of the principal owners of the property, worked in the *St. Eugene* for many years, and his knowledge of the large ore-bodies that existed at this latter mine has been an incentive to explore the ground on the opposite side of the lake, in the hope of finding a repetition of conditions. So far he has been unsuccessful, but deserves credit for the large amount of work that he has personally accomplished.

Railway Mine Group.

This group comprises five claims, situated near the wagon-road at a distance of 5 miles south of Moyie. The finding of iron-stained material carrying traces of silver, lead, and zinc, and lying under the detritus from the quartzite bluffs forming the crest of a ridge, led to prospecting in an endeavour to find its source of origin. As the covering of detritus consisted of large angular fragments of quartzite and increased in depth as work advanced, progress was slow and laborious.

The work done during the summer consisted of driving several open-cuts, which showed a layer of iron-stained dirt lying immediately under the broken quartzite and on top of a compact glacial wash. Samples of the dirt at the side of the open-cut gave the following values: Silver, 1 oz. to the ton; lead, 0.4 per cent.; zinc, 0.5 per cent.

Copper Belt Group.

This property, comprising a group of three claims—namely, *Tillicum*, *Rob Roy*, and *Copper Belt*—is controlled by W. S. Santo, of Cranbrook. The claims are situated on 6-Mile hill, lying between the Cranbrook–Fort Steele road and the railway; hence excellent transportation facilities are available. The strata in the immediate vicinity of the workings are freely exposed in a bluff above the tunnel and consist of thinly bedded limestone and slate, dipping at an angle of about 50° to the north-west and striking N. 60° E.

The first work undertaken many years ago was the sinking of a shaft on the vein, probably at the point of discovery. The shaft is vertical for the first 40 feet and then follows the vein on an incline for 35 feet. No work has been done here for some time, and, as the condition of the ladders was doubtful, no attempt was made to examine the bottom of the shaft.

A sample of carefully sorted ore was taken from a few tons lying on the dump; this gave the following returns: Gold, 0.04 oz.; silver, 0.9 oz. to the ton; copper, 8.75 per cent. The ore consisted principally of copper-stained quartz, the copper being mostly in the oxidized state. The sulphides are finely disseminated in a quartz gangue.

In order to tap this vein at a vertical depth of 75 feet a tunnel was driven into the base of a bluff for about 170 feet, the intention being to connect with the shaft, but the work was

abandoned before this objective was reached. By continuing this tunnel for about 43 feet the present owner intersected the vein, the hanging-wall of which is exposed in the face of the tunnel at a distance of 213 feet from the portal.

Here the structure indicates that mineralization has taken place along a sheared fault fracture; the vein-matter consisting of broken country rock and quartz. The hanging-wall is well defined by a streak of gouge and has a strike of about N. 70° W. and dips at 60° in a south-westerly direction. Green copper-stains indicate the mineralization to be more pronounced within about 5 feet of the hanging-wall. On the foot-wall side the country-rock, consisting of slate, is seamed with stringers of quartz in which occasional specks of chalcopyrite may be seen while thin films of native copper denote slight secondary enrichment. A sample of the most highly stained material ran as follows: Gold, trace; silver, 0.5 oz. to the ton; copper, 0.6 per cent.

Drifting on the vein near the hanging-wall and surface-stripping across its strike in a south-westerly direction from the shaft would, in the writer's opinion, be the best method of carrying on further development and exploratory work.

Among other activities in this Division the following may be mentioned. J. Angus was engaged during the season in doing further exploratory work on a silver-lead prospect situated on Hellroaring creek. The Evans Bros. are reported to have done further work on their copper property, known as the *Evans* group, on Whitefish creek. Dewey Bros. continued development work at the *Mystery* group of Alki creek, which is also a copper property. J. F. Hutcheon directed further work on the *Park* group, near Marysville, from which 14 tons of silver-lead ore was shipped. At the *Homestake* on Perry creek the workings were cleaned out and further work of an exploratory nature was done under the direction of N. A. Wallinger, of Cranbrook. D. McIntosh is reported to have a small crew of men working at the *Brenda* group on Copper creek near Skookumchuck.

Placer-mining.—On Wildhorse creek the property of the Gamble Mining Company and other placer-ground has been acquired by the Wild Horse Creek Mining Company, in which Commander Pilcher and associates are interested. The big ditch taking water from a point high up on the main creek is being overhauled and a new flume built, which work was being done in a substantial and workmanlike manner. Besides this, camp buildings are being erected and everything put in shape for next season's hydraulic operations. During previous years the scarcity of water has always been a serious handicap, but no danger of any serious water-shortage is anticipated as soon as the new source of supply for the monitors is available. A measurement taken by the writer at the dam during the latter part of October, which was an exceptionally dry month, indicated the flow at 12 cubic feet a second. Every precaution is being taken by the company to ensure the success of the enterprise, and, if the values and yardage come up to expectations, Wildhorse creek will again become the scene of placer-mining activity over an extended period.

On Perry creek A. J. Palmquist had a small crew of men working during the season. It is understood that he intends to put in a dam above the falls, but what progress has been made in this direction is not known.

WEST KOOTENAY DISTRICT.

AINSWORTH MINING DIVISION

AINSWORTH CAMP.

Florence. During the earlier part of the season the news that the *Florence* mine had been acquired under option by Detroit capitalists created a stir and big developments were expected. Unfortunately things did not materialize and the deal fell through before any marked progress had been made. One particular scheme in connection with plans for future development, which also concerned other mine-owners and settlers along the lake, was to acquire an adequate supply of power from the city of Nelson. With this object in view an arrangement was concluded between the city and the mining company whereby the city was to extend its power-line to Balfour and the company to complete it to the mine. The city lived up to its part of the contract and the line now terminates at Balfour. So far the mining company has been unable to continue it, but intends doing so as soon as financial arrangements can be made.

After all rights under the option on the *Florence* had been relinquished, R. W. Lloyd, the superintendent, and three or four others took a lease on the mine and mill. Work was being confined by them to an easterly and westerly fissure from the No. 5 or lowest level. This had been stoped to a height of about 150 feet. The face of the stope was approximately 40 feet long, in which length the width of the vein varied from 3 to 14 feet. In the wider places the ore-lenses, partly replacing the schist along lines of fracture, were separated by barren ground, which meant that in order to win the ore a large percentage of waste had to be mined. At the time of the writer's visit both ore and waste were being put through the mill without any attempt at sorting. The ore consisted of coarse cube galena, zinc-blende, and iron pyrites in a siliceous gangue.

The company had a few men working under contract to advance the No. 2 level. The result of this work is being watched with interest, as it is hoped to lead to the development of a rich ore-body.

A Mancha storage-battery locomotive was being used for underground and surface haulage and is said to have given good satisfaction.

Lakeshore. This property, comprising a group of twelve or fourteen claims, belongs to the Lakeshore Mining Company, financed by American capital. E. J. Edwards, of Spokane, is the manager, under whose supervision development-work has been carried on during the last three years. The area covered by the claims adjoins the *Florence* to the south and extends from the shore of Kootenay lake up the hillside in a westerly direction.

The formation in this vicinity has been classified by S. J. Schofield, of the Geological Survey, as belonging to the Carboniferous period and consists of uniformly bedded limestones, schists, and quartzites, striking north and south and dipping at an angle of 30° to the west. With general reference to this formation in the Ainsworth camp, the ore-deposits are of three distinct types, all of which are economically important—namely, fissure-veins which cut the bedding-planes at an angle; those which conform to the dip and strike of the strata (the latter generally being found to lie in the quartzites of the Josephine formation); and replacement deposits in limestone.

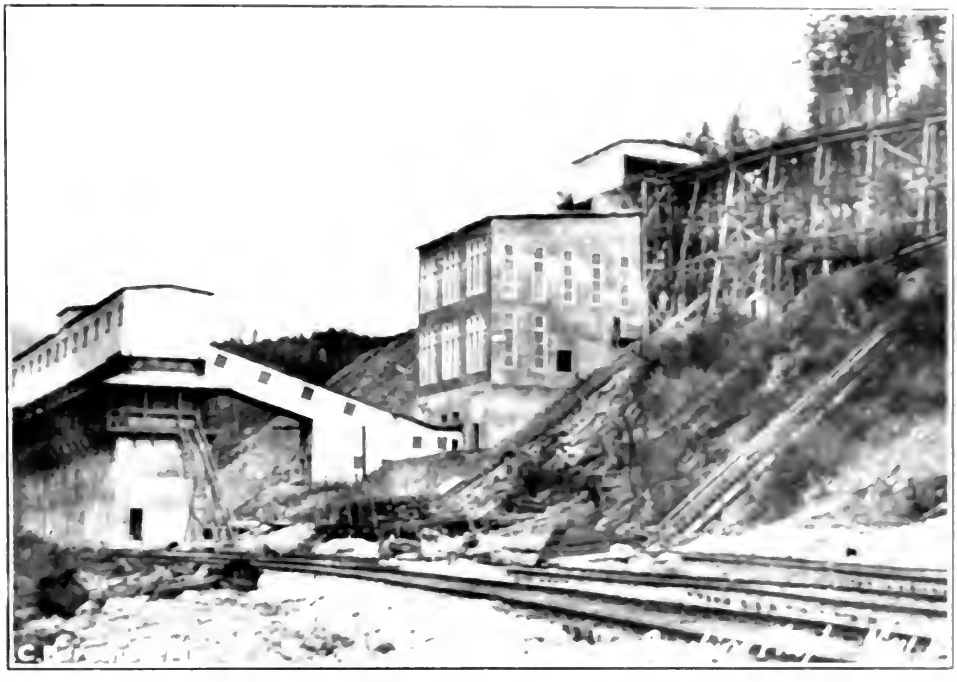
Work done by this company includes the driving of a 750-foot crosscut from the surface to explore the ground at a depth of about 200 feet below the surface showings and to connect with an old 160-foot shaft. Near the end of this crosscut a wide zone of sheared ground was encountered, indicating a post-mineral faulting and shearing movements in the plane of the vein, which latter probably conforms to the dip and strike of the enclosing limestone. The face of the tunnel is in limestone, sparsely impregnated with pyrrhotite, chalcopyrite, and zinc-blende.

A 49-foot raise from this tunnel connects with an intermediate drift running in an easterly and westerly direction, which crosscuts the sheared zone and terminates to the west in barren and decomposed limestone which forms the wall of the break. The sheared material is composed of finely crushed country-rock, with which is mixed a small percentage of powdered galena and occasional boulders of ore. A sample taken along the side of the drift for a distance of 36 feet, of the finely crushed material, ran: Gold, 0.02 oz.; silver, 2.6 oz.; to the ton; lead, 7.1 per cent.; zinc, 4.7 per cent. A sample taken from the boulders of ore ran: Silver, 5 oz. to the ton; lead, 35.6 per cent.; zinc, 8.9 per cent.

Further development was contemplated to prove the extent and character of the deposit, and so far the results offer encouraging possibilities. The old workings at the bottom of the shaft which connect with this intermediate drift did not disclose ore in any quantity and had not been advanced far enough in a westerly direction to reach the sheared zone.

Silver Hoard. This property, comprising a group of five Crown-granted claims—the *Silver Hoard Fr.*, *Dellie Fr.*, *Dellie*, *Nellie Fr.*, and *Little May*—is situated at an elevation of 4,300 feet and at a distance of 7 miles by road from the town of Ainsworth. The property belongs to the Silver Hoard Mines, Limited, of which W. S. Hawley, of Spokane, is manager. During recent years the Company has not actively operated the mine, but the buildings and equipment seemed to be in a good state of repair.

The mill, which has a rated capacity of 60 tons a day, is situated at the top of a 200-foot incline shaft, which gives access to the workings. The flow-sheet embodies the gravity and oil-flotation processes, but, judging by the character of the ore, requires some alterations and improvements to obtain the best results. Its equipment consists of jigs, three Overstrom tables, a 5-cell Ziegler flotation unit, and accompanying crushing, screening, and classifying plant.



Sullivan Mine Crushing Plant, Port Steele, N.B.

Hall River Power Plant, Port Steele, N.B.

A 50-horse-power electric motor drives the mill machinery, and another an Ingersoll-Rand 2-stage compressor having a capacity of 450 cubic feet of air a minute. Additional equipment includes a 60-horse-power steam-engine, a 75-horse-power boiler, and a 15-horse-power boiler, as well as a small sawmill and hoist.

The ore-body occurs as a replacement deposit in limestone near its contact with overlying black argillites. It is irregular in character, but conforms to the dip and strike of the strata, which are respectively 45° to the west and north and south.

There is evidence that the somewhat peculiar conditions found to exist at the adjoining property (the No. 1) also occurs here—namely, a fold in the strata changes the dip from west to east below the 100-foot level. Another interesting feature is the presence of caves in the limestone foot-wall, formed by the action of percolating waters along a cross-fracture. One of these caves, forming a natural incline shaft, has been made good use of as such. It is also said to have eliminated the necessity of pumping.

The ore consists of two grades—namely, disseminations of finely crystalline zinc-blende and galena with silver sulphides in small cracks and fissures. Ore of this character and some from the zone of oxidation has been mined by leasers from above the 50-foot level and 80 tons were shipped during the year. One shipment, of 43 tons, ran as follows: Silver, 125 oz. to the ton; lead, 3.8 per cent.; zinc, 14 per cent. Another, of 40 tons: Silver, 112.5 oz. to the ton; lead, 5 per cent.; zinc, 14 per cent.

The other class of ore, consisting of a mixture of coarse cubic galena and zinc-blende with small quantities of pyrite and chalcopyrite, probably forms the bulk of the tonnage left in the mine, but owing to its irregularity, both in occurrence and grade, an opinion of the amount available for milling could only be formed after a survey and extensive sampling. The underground workings develop the ore-zone to a depth of 200 feet and in all comprise some 2,000 feet of work. It is understood that plans are under way to resume operations on a larger scale. At the time of examination three or four leasers were working.

It has been recently reported that the *United* mine has been acquired by Spokane interests and a company called the United Mines, Limited, has been formed to finance the necessary outlay for development. It is understood that E. J. Edwards will have charge of the work.

The *Spokane-Trinket*, *Silver Hoard*, *Krao*, and *Maestro* were worked by leasers.

RIONDEL.

At Riondel the only work reported as being done during the year was on the *Kirby* group, where the Shepherd Mining Company, under the management of A. J. Curle, is continuing development.

Bluebell.

The *Bluebell* has remained idle during the year. This well-known property can not only boast of having a large tonnage to its credit, but of being one of the most beautifully situated properties in the whole of the Kootenays. Right on the shore of Kootenay lake, with a daily boat service and water-power for driving the concentrator and mine plant, are conditions to be envied by many a mine operator in this country. These features, added to the fact that there is a large tonnage of low-grade lead-zinc ore and good possibilities for the development of new ore-bodies, appeal to the writer as making it a property well worthy of careful investigation by large interests. A great deal has been written on it from time to time, but the following notes may be of interest and serve to refresh the memory of those already familiar with the property.

For many years the property has been managed by S. S. Fowler, under whose direction mining and development-work has been prosecuted with in a systematic and businesslike manner. Unfortunately, development and mining of the deposit on a scale commensurate with its size have been handicapped by lack of sufficient capital. One of the striking geological features is that to the east the deposit is bounded by the wall of a vertical fault running north and south. To the east of the fault escarpment the area is occupied by low-lying swampy ground, which has not been prospected.

The theory advanced by Mr. Fowler, that this area has subsided and that ore might be expected at no great depth, appears to be a logical conclusion to draw and well worthy of testing by the diamond-drill. To the west of the fault the vein has been developed to a depth

of 700 feet on the dip. There is said to be good ore at the bottom of the shaft, but of recent years these workings have not been unwatered.

The flow of water from the mine-workings is estimated at 200 gallons a minute; hence would not be difficult to cope with. The water-power available for running the plant is about 350 horse-power at low-water stage.

PROPERTIES TRIBUTARY TO THE KASLO–NAKUSP RAILWAY.

Whitewater. This year the Whitewater Mines, Limited, was organized with a share capital of 1,200,000 shares at $1 each par value. Six hundred thousand of these shares were issued to the owners of the *Whitewater* and *Whitewater Deep* mines in consideration for the purchase of such mines and the two properties were consolidated in the above company. The list of directors includes the name of W. H. Burgess, of Kaslo, who has long been identified with the properties as managing director and secretary-treasurer. The holdings of the company comprise nine Crown-granted claims, formerly the *Whitewater* mine, and fifteen Crown-granted claims, formerly the *Whitewater Deep* mine.

The record of the *Whitewater* mine covers a long period of activity, although during the last nine years the production, amounting to 6,793 tons and yielding net smelter returns, after deducting freight, of $367,966, has been maintained by leasers. The total production to date is 51,863 tons, representing a net value, after paying railway and smelting charges, of $1,839,422.

During the year the company accomplished about 500 feet of development. Leasers were also busy in some of the old upper workings. The production from this source was 210.5 tons of silver-lead ore and 132 tons of silver-zinc ore. It is anticipated that an active development campaign will be carried on during the coming year under the direction of R. H. Stewart, consulting engineer for the company.

Utica. Colonel H. H. Armstead entered negotiations during the year with the Utica Mines, Limited, and acquired the property under a contract from the liquidator to deliver title as soon as a new company, called the Canadian Mines Merger, Limited, was organized and ready for business. Under this arrangement the old *Utica* shareholders will receive shares in the new company. The low tunnel was advanced 300 feet before operations were suspended owing to water-shortage for power purposes. According to recent reports, work will be resumed in the spring as soon as weather conditions will permit.

Charleston Group. This group, consisting of the *Charleston*, *Kingston*, *Colorado*, *Keystone Fraction*, *Corsan*, and *Colorado*, is assessed to the Northern Trusts Company, of Winnipeg, with exception of the *Colorado*, which is in the name of A. T. Garland, of Kaslo. Recently the property was operated for a short time by the Charleston Silver Mines Company, of Vancouver, which, it is understood, relinquished its option during the early part of the year owing to lack of funds. A. J. Harris, one of the original owners and who for many years has been associated with the property, carried on development-work during the season with a small crew of men.

The vein on which most work has been done occurs in slate near the contact of the Kaslo volcanic formation. It has been formed along a sheared fissure having a north-westerly strike and dip of 45° to 60° to the south-west. The workings consist of five adits driven along the direction of the strike and representing over 2,000 feet of work, according to the mine-map.

Recent work has been confined to the Harris tunnel, which was examined by the writer with a view to ascertaining whether the tonnage available for shipment warranted Government assistance being given towards further trail-construction. This tunnel is situated on the westerly side of Whitewater creek at an elevation of 5,100 feet. The total length of the level is about 800 feet. It follows the course of a sheared fissure, generally marked by a well-defined hanging-wall and filled with crushed and slickensided slate, with quartz fragments and stringers, in which filling bunches of ore occur at intervals. The mineralization is most pronounced over a length of 150 feet along the drift.

In this locality raising and stoping has been undertaken. Above the level the ore-shoot has been partially explored by raises and an intermediate drift driven at about 15 feet above the level. The bulk of the ore exposed in these workings was very zincky in character, grading from zinc-blende to a mixture of zinc-blende and galena, but owing to exceptionally high silver values, which were associated with grey copper (freibergite), it was possible to mine, sort, and cob a silver-lead shipping product. At the face of a raise, some 30 feet above the level, the

ore-body apparently had a tendency to widen and carried a higher percentage of lead. A sample taken here across a width of 3 feet gave the following returns: Gold, 0.02 oz.; silver, 214.0 oz. to the ton; lead, 24 per cent.; zinc, 35.3 per cent. While a sample taken from a 20-ton pile of sorted ore from these workings ran: Gold, 0.02 oz.; silver, 253.0 oz. to the ton; lead, 43.4 per cent.; zinc, 22.2 per cent.

Besides the silver-lead product, a good grade of zinc ore could be obtained with little sorting. A sample of sorted zinc ore ran as follows: Silver, 20.5 oz. to the ton; lead, 5 per cent.; zinc, 56.1 per cent. According to the mine-map, this ore lies about 200 feet below the surface on the dip of the vein, while the No. 5 level, driven 180 feet below, has not been advanced far enough to get under this ground.

At the time the property was visited, early in the year, a crosscut was being driven from the Harris tunnel in a south-westerly direction to tap a vein showing on the surface, but apparently had not reached its objective.

Keystone. This claim, lying to the south and partly adjoining the *Charleston*, has had a considerable amount of work done on it, where a vein striking N. 60° W. and dipping at 70° to the south-west occurs in a slate formation. The vein-filling, principally consisting of a low-grade mixture of lead, zinc, and iron sulphides in siliceous gangue, is traceable along the roof of the upper tunnel, which has a length of about 150 feet. A sample taken across a width of 4 feet near the face ran: Silver, 3.5 oz. to the ton; zinc, 8.5 per cent.

The lower tunnel, driven from a point about 100 feet farther down the hill, has not been advanced far enough to explore the most favourable ground. Small lenses of silver-lead-zinc ore, however, were encountered, which have yielded a small tonnage. A sample taken from a small pile of sorted ore ran: Gold, 0.02 oz.; silver, 117.8 oz. to the ton; lead, 34.5 per cent.; zinc, 8.7 per cent.

A great deal of work has been done at various other places on the claims, but to have made a thorough examination of same would have taken more time than the writer had at his disposal on the occasion of his visit.

The property is conveniently situated to the railway and within a short distance of the *Whitewater* mine road, so transportation of ore and supplies presents no serious problem.

SOUTH FORK OF KASLO CREEK

Cork-Province. W. H. Burgess, the secretary, reports that this mine has worked steadily all year with a crew of from fifteen to twenty men. The mill was run from June to November, when closing down was necessitated by shortage of power. Several additions and improvements to the plant, together with the better grade of ore encountered on the No. 4 level, have resulted in the production of a higher grade of concentrate than has been made heretofore, running as high as 70 oz. in silver and 70 per cent. lead. The new Ingersoll-Rand compressor, having a capacity of 725 cubic feet of free air a minute, has been a source of great satisfaction. The company intends making improvements to the power plant next spring, which, it is anticipated, will enable them to keep the mill going an additional three months each year. All things considered, the prospects for next year are encouraging.

Gibson. This property, which has been lying idle for the last few years, has been acquired by the Daybreak Mining Company, of Kaslo, of which J. T. Roberts, of Portland, Oregon, is president. The camp buildings were destroyed by forest fires in 1921, as well as a lot of plant and equipment. Since the present company took over the property during the year good progress has been made towards getting things in shape for development; including the erection of an 18- by 32-foot cabin, a compressor house, snow-sheds, and a new trail. The lower tunnel has been retimbered and it is understood a contract has been let to advance it 1,000 feet.

Silver Bear Group. This group, comprising three claims, is situated on the South fork of Kaslo creek at a distance of a few miles beyond the *Cork Province*. Since the property was visited and reported on in 1919, M. S. Davys, of Kaslo, became interested, and after shipping 10 tons of high-grade silver ore from shallow workings in the vicinity of the outcrop, decided to drive a long tunnel from the level of the wagon-road which would gain an additional depth of 300 feet. This was deemed necessary principally owing to the fact that the deep ravines cutting the hillside and crossing the strike

of the vein prohibited drifting for any distance without striking daylight. At the time of the writer's visit this tunnel was in 540 feet, with, it was estimated, about 200 feet to go to reach its objective.

The vein lies in a crushed zone along the contact of slate and limestone. The ore consisted of carbonates and a little sulphide ore, carrying galena, zinc-blende, and iron pyrites. Both classes of ore carry high silver values and occur, as far as could be ascertained, as an irregular replacement deposit in limestone.

The surface of the hillside being covered with overburden and heavily timbered, ledge-matter was only visible where trenching had been done and where the formation was laid bare in the steep side of a gulch. Enough work of this nature had been done, however, to demonstrate that the crushed zone was persistent along the hillside for a considerable distance and to indicate the presence of two veins about 80 feet apart.

To facilitate the driving of the tunnel a small compressor driven by a Pelton wheel was installed near the portal. Two good cabins situated at a short distance up the hillside provide accommodation for a small crew of men.

Since writing the above a report from M. S. Davys at the end of the year states: "The new lower tunnel, 760 feet in length, was driven in, striking the first foot-wall vein at 730 feet. The vein shows strong, carrying mixed mineral at this depth, 400 feet below surface. The upper tunnel has been driven ahead to strike the hanging-wall vein, 80 feet east of the foot-wall vein. Here it is showing up fairly well, with some good high-grade ore mixed with the lower-grade material."

Martin Group.* This property, consisting of five claims owned by J. Power and J. Carter, of Kaslo, is situated on the south-western side of Dago creek, 2½ miles up the *Flint* mine trail from the South fork of Kaslo Creek wagon-road, which it leaves at a point about 4 miles from the railway at Zwicky. The elevation of the lower tunnel is about 6,000 feet above sea-level. The old underground workings, which aggregate some 1,200 feet of tunnelling and raising, develop a fissured zone in granite, in which occur shoots of galena. The ore is clean, requiring little sorting before shipping. A small shipment made in 1915 averaged about 78 oz. in silver to the ton and 60 per cent. lead.

When the property was visited in July a small crew was engaged in putting up a raise to tap a good showing in an intermediate level between the upper and lower tunnels. This ore-showing was from 60 to 70 feet long and varied in width from 6 to 18 inches. A grab sample from a few sacks of ore on the intermediate level gave: Gold, 0.01 oz.; silver, 86.9 oz. to the ton; lead, 59.4 per cent.; zinc, 7.1 per cent.

Howser Lake.

Surprise Group.* This property, consisting of the *Elated*, *Surprise No. 2*, *Bobbie Burt*, and *Surprise Fractional*, Crown-granted claims, owned by Victor B. Johnson, of Portland, Ore., and F. A. Devereux, of Victoria, B.C., was bonded early in the year by W. B. Smith and I. L. Eirnheart, of Spokane, Wash., who started work about the beginning of May. The *Surprise* group is situated on the northern side of Glacier creek, 3¾ miles by trail from the Argenta-Howser road, the distance from the mine to the nearest shipping-point at Howser Station being about 6 miles. The elevation of the camp at the creek-level is about 2,200 feet and the elevation of the upper tunnel about 3,500 feet above sea-level. The rocks of the area include limestone, slates, quartzites, and schists, having a strike of about N. 25° W., with dips from 40° to 45° to the north-east.

The ore is grey copper carrying high silver values, with which are associated unimportant amounts of galena and zinc-blende. The grey copper occurs disseminated through quartz in flakes, veinlets, and streaks. The quartz itself occurs in lens-like masses in a sheared and crushed zone conforming to the bedding-planes of the country-rocks, which are slates and schists.

The lead, which strikes up and over the summit from the *Surprise* workings, is said to be traceable a long distance by float, outcroppings of quartz, and some open-cuts and trenching. John Noihl, Bob Bowles, and Wm. Clarke all have claims on the supposed extension of the lead on the Howser Lake slope.

On the *Surprise* property most of the work has been done on the upper tunnel level, where the mineralized zone attains an approximate width of 100 feet. Here the quartz occurs in wide bands in the zone, separated by slate and schist partings. All the quartz is more or less mineral-

lzed with grey copper, with the characteristic blue and green stains due to oxidation. The mineralization is apparently more pronounced as the foot-wall of the zone is approached. This foot-wall is smooth and very well defined in contrast to the hanging-wall, which is indefinite. The upper tunnel, driven as a crosscut for the first 25 feet, then follows the foot-wall of the vein for about 115 feet, when it swings off to the right, angling across the vein for a further 20 feet.

The ore was encountered a short distance in from the crosscut and continued for a length of 85 feet to the bend, where the foot-wall was left by the tunnel. Throughout the 85 feet the whole width of the tunnel was in quartz impregnated with grey copper, the mineralization being highly concentrated for a width of several feet on the foot-wall side. At a point 80 feet in from the portal of the tunnel an 18-foot crosscut to the right is all in quartz more or less impregnated with grey copper throughout.

At the time of the writer's visit to the property (in June) ore was being stoped above the tunnel near the bend at a point about 40 feet below the surface. The short section of tunnel beyond the bend was in quartz containing grey copper sparsely disseminated throughout. Below the stope an old winze has been sunk 80 feet on the foot-wall of the lead. In this winze the ore is continuous for the first 40 feet, at which point it rakes southerly into the side of the winze. The ore in the winze is the same as in the tunnel, the high-grade ore being on the foot-wall.

Samples of the ore from the upper tunnel assayed as follows: Selected ore from stope: Gold, 0.21 oz.; silver, 739.9 oz. to the ton; copper, 23.1 per cent.; antimony, 16.2 per cent. Roughly sorted ore from stope: Gold, 0.06 oz.; silver, 173.2 oz. to the ton; copper, 4.5 per cent.; antimony, 5.1 per cent.

At the same elevation and easterly from the above-described tunnel there are two short tunnels in the mineralized zone. One of these tunnels, about 100 feet easterly from the main tunnel, follows close to the hanging-wall of the vein for a short distance, exposing some grey copper in quartz on the eastern side of the tunnel. Between this working and the main tunnel another short tunnel develops some quartz mineralized with disseminated grey copper for a width of 3 to 4 feet.

About 100 feet vertically below the upper tunnel an old crosscut has been driven over 300 feet without developing any ore. However, this tunnel apparently encountered and passed through the same well-defined smooth foot-wall as in the tunnel above. There is some barren quartz on this foot-wall which was not drifted on.

Fifty-nine tons of sorted ore was shipped by Mr. Smith during the summer, but it is reported that the smelter returns were not up to expectations, which may be due to the difficulty of sorting ore of this character. The property is very favourably situated, with an abundant supply of mining-timber close at hand and ample water-power available for mining and milling.

Lakeside Group.—This property, consisting of the *Lakeside No. 1* and *No. 2* claims, owned by the Matthews Bros., G. H. Scott, and J. N. Watson, is situated on the east side of Howser lake, 3 miles northerly from Howser. The claims are staked along a low ridge which parallels the lake for several miles, the summit of the ridge being only a few hundred feet in elevation above the lake-level. Along the ridge, and on both sides of it, a few open-cuts and trenches have been made in limestone mineralized in places with disseminated lead, zinc, and iron sulphides. Very little work has been done as yet to determine the extent of the mineralization, which is apparently of the replacement type and conforms to the bedding of the limestone.

Two samples gave the following results: Across 3 feet in open-cut on eastern slope of ridge: Gold, 0.02 oz.; silver, 2 oz. to the ton; lead, 28.0 per cent.; zinc, 7.5 per cent. Selected ore from open-cut on Howser Lake slope: Gold, 0.01 oz.; silver, 1.2 oz. to the ton; lead, trace; zinc, 7.2 per cent.

The overburden is light and further prospecting may disclose ore-bodies of commercial value.

Red Elephant.—Situated on Hall creek. Further work was done this year by the owners, Hugh McKay and J. W. Power, of Kaslo.

LIST OF PRODUCING MINES, AINSWORTH MINING DIVISION, SHOWING TONNAGE SHIPPED.

Mine.	Locality.	Weight.	Character of Shipment.
		Tons.	
Florence	Ainsworth	8,261	Silver-lead ore.
Silver Heard	Ainsworth	89	Silver-lead ore.
Krao	Ainsworth	99	Silver-lead ore.
Maestro	Ainsworth	29	Silver-lead ore.
Tariff	Ainsworth	9	Silver-lead ore.
Whitewater	Retallack	210	Silver-lead ore.
Whitewater	Retallack	132	Silver-zinc ore.
Caledonia	Adamant	1	Silver-lead ore.
Cork-Province	South fork, Kaslo creek	4,070	Silver-lead ore.
Silver Bear	South fork, Kaslo creek	10	Silver-lead ore.
Howser Mining Co.	Glacier creek	59	Silver-copper ore.
Sailor Boy	Crawford creek	8	Silver-lead ore.
Liberty	South fork, Kaslo creek	3	Silver-lead ore.

NELSON MINING DIVISION.

Although there have been no new developments of a startling character and things have, perhaps, been a little quieter than usual, there is no reason to feel pessimistic as to the future, for the district offers many opportunities alike for the prospector and capitalist.

The opening of the Nelson–Ymir road affords easier access to the many properties situated between Nelson and the boundary, and will no doubt have a favouring influence on this section of country.

The heavy construction-work being proceeded with at Bonnington, where the West Kootenay Power and Light Company is adding 60,000 horse-power to the plant, has given employment to many men. The power generated is almost entirely consumed by metallurgical and mining plants.

The *Molly Gibson* was worked by a small crew of men during the season under the direction of W. A. Cameron and 72 tons shipped to Trail. The *Granite-Poorman* was worked by leasers and a small shipment of 10 tons made to Trail. The *Humming Bird* group, situated at the head of 5-Mile creek, was bonded by R. Qua to W. F. van Vactor and associates. This is a new prospect on which a limited amount of surface work has disclosed some high-grade gold values.

Work was continued on the *Gold Hill* by the owner. This property is situated near the head of 49 creek and has produced in recent years a small tonnage of high-grade gold ore.

YMIR CAMP.

Around Ymir prospecting has been rather more active than usual, some of which has met with encouraging results. It is to be hoped that the old-timers who are familiar with the conditions will continue their efforts, as there is much left for the prospector to do in the hills of this area, which also applies to many other parts of the district.

Unfortunately the *Yankee Girl* mine has remained idle this year. It is a property well worthy of investigation for large interests and its operation would do a lot to stimulate mining and prospecting around this camp.

Goodenough Group. This group, comprising three claims—*Goodenough*, *Demaricott*, and *Little Nell*—is owned by O. Lovell, Alec MacDonald, and H. Jackson, of Ymir. The work done has been confined to the *Goodenough* claim, which adjoins the south-westerly boundary of the *Ymir* group. The property is conveniently situated to the old wagon-road leading to the *Ymir* mine and within about 3 miles of the railway. In the earlier days of the camp, when the famous *Ymir* mine was being operated with 80 stamps working continuously at the mill, the areas in the vicinity of this rich deposit naturally attracted the attention of the prospectors. Many old shafts, tunnels, and open-cuts remain to mark their efforts to pick up the extension of the *Ymir* vein in an easterly and westerly direction.

On the *Goodenough* exploratory work was done, which disclosed mineralization; but no relation could be established by the writer between this deposit and that of the *Ymir* mine. The formation underlying the area covered by this claim is composed of schists of the Pend

d'Oreille group. A noticeable feature, which may bear close relation to the structural conditions, is the intrusion of a granitic dyke. This, passing within a short distance of the workings, continues in a north-easterly direction past and in close proximity to the deposit at the Dair mine.

Early work, consisting of two shafts, 40 and 35 feet deep respectively, and numerous open-cuts, disclosed two quartz veins, striking north-easterly and converging to the south-west. The values not being sufficiently encouraging at this point, the owners decided to prospect the ground at a point about 350 feet south-westerly from the shaft and at an additional depth of 225 feet. With this object in view a tunnel was driven into the hillside for a distance of about 135 feet in a north-easterly direction. This tunnel follows the hanging wall of a sheared fault fracture filled with crushed argillites.

At a point about 100 feet from the portal a short crosscut driven into the foot wall side disclosed about 2 feet of crushed vein-matter carrying sulphides of lead, iron and zinc lying next a narrow aplite dyke. The more massive ore consisted of a finely crystalline mixture of lead, zinc, and iron sulphides. Two samples taken across an average width of 22 inches gave the following average values: Gold, 1.85 oz.; silver, 34.4 oz. to the ton; lead, 3 per cent., zinc, 1.9 per cent. A sample of the crushed and silicified argillites in the hanging wall of the vein gave negative results.

At the time of examination so little work had been done on the ore that it was not possible to form an opinion as to how it would develop, but the indications were encouraging, and from recent reports the results of further work have been highly satisfactory.

Golden Crown Group.

This group, comprising five claims, is situated on Wildhorse creek, at a distance of about 2 miles from Ymir, and is owned by W. Dowling and D. T. Graney, of Ymir. The property adjoins, or almost adjoins, the *Goodenough* group to the south-west. The area is partly underlain by argillites of the Pend d'Oreille group and partly by the rocks of the Rossland volcanics; the contact between these two series being on the upper part of the claims. The workings, consisting of tunnels in various localities, open-cuts, and shallow shafts, have not revealed as yet any ore of economic importance.

On the *Agnes*, which is the most westerly claim, a strong quartz outcrop has been partially prospected by a tunnel and open-cut.

It is claimed that good assays have been got from the outcrop, but a sample taken by the writer was disappointing, as only negligible values were obtained. However, this should not be interpreted to mean that there are no values, for the quartz showing had a width of about 15 feet, and as gold values are often erratic it is quite possible that other sampling would show better values.

Of the other workings, two tunnels which were driven at a vertical distance of 200 feet apart crosscut a wide shear-zone composed of crushed argillites in which numerous inclusions of small quartz stringers can be seen. A sample taken across 2 feet of some of this material, which was stained with oxide of iron, gave negative results. Most of the work was done many years ago, but recently D. T. Graney has been continuing development.

From the writer's observations there is evidence of shearing movements along a north-easterly course and lying between a strong granitic dyke to the west and the contact of the Rossland volcanics to the east, and in all probability similar structural conditions prevail on the *Bi-metallic* claim of the above group as on the *Goodenough*.

Derby Group.

Situated on the south side of Wildhorse creek at about a mile beyond the confluence of the North fork. The workings lie at an altitude of 4,700 feet. The property is owned by J. H. Clarke and T. Wilkinson of Ymir. The first working is a deep open-cut on the *Derby* claim, which exposes a quartz vein striking N. 70° W. and dipping vertically. The vein occurs in granite and apparently lies next to an aplite dyke. A sample taken across 32 inches gave the following returns: Gold, 0.03 oz.; silver, 1.3 oz. to the ton.

At a short distance from here a 60-foot crosscut on the *Mantle* claim intersects a parallel vein which has been drifted on in a direction of S. 80° E. for 30 feet. In the roof of this drift a 10-inch streak of ore is exposed; a sample across this ran: Gold, 0.2 oz.; silver, 3.2 oz. to the ton; lead, trace; zinc, 3.9 per cent. The ore is quartz with iron pyrites, a little galena, and zinc blende. In the floor of the drift the vein shows a tendency to widen and in the bottom of a

10-foot sump it is said to have a width of 20 inches; this could not be examined on account of water.

These workings have been driven about 25 feet below the outcrop, where a 20-foot open-cut and tunnel exposed a width of 3½ feet of oxidized vein-matter. Following in the direction of the strike of the vein along the hillside and about 150 feet lower down, an open-cut shows several small streaks of bluish quartz on either wall of the vein, which here lies next a lamprophyre dyke. A sample of this quartz gave negligible returns.

Teddy Fraction.

One of the claims of the *Garfield* group, owned by Mrs. M. Peters, A. J. Campbell, and J. H. Clarke, of Ymir. It is located on the side of a gulch at a short distance in a westerly direction from the *Derby* group and lies along the contact of granite and a narrow belt of schists and quartzites of the Pend d'Oreille group. At an elevation of 5,150 feet a shallow trench exposes the outcrop of a sheared fissure having an apparent strike of S. 35° W., in which narrow bands of ore occur. The ore is quartz with a little galena, zinc-blende, and iron pyrites, a sample of which ran: Gold, 0.31 oz.; silver, 4.1 oz. to the ton; lead, 5 per cent.; zinc, 2.1 per cent. With the very limited amount of work done, little knowledge could be gained regarding the character or possibilities of this deposit, but conditions appeared to fully warrant more prospecting.

Pilot-Good Hope Group.

This group, comprising the *Good Hope*, *Good Hope Fraction*, *Stanley Fraction*, and *Pilot Fraction*, is situated at some 2,000 feet above Wildhorse creek on a very steep hillside having a slope of about 45°. Deep gulches cutting the mountain-side mark the path of snowslides and add to the rugged nature of the country. The narrow ridges between these gulches are sparsely covered with overburden and vegetation. Access is gained to the property by a good wagon-road from Ymir as far as the *Wilcox* mine, a distance of about 9 miles, from whence an exceedingly steep road leads for 1½ miles to the *Foghorn* cabin; this is a good stopping-place for the night, as from here a trail leads up the mountain, by which the mine-workings can be reached in short time.

The area is underlain by granodiorite of the Nelson batholith, in which an occasional remnant of sedimentary rocks is included. Lamprophyre dykes cut the granite, but, being post-mineral, bear no relation to the mineralization. The veins are small quartz-filled fissures formed along sheared fracture-planes and invariably have a well-defined hanging-wall of gneissic granite, with an indefinite foot-wall. They have a north-easterly strike and a dip of 48° to the north-west or into the hill, roughly conforming to the master-joint planes of the granite.

Pilot.—On this claim a crosscut tunnel has been driven at an elevation of 6,450 feet for a distance of 120 feet to tap a vein which outcrops 65 feet higher up the hill. Nothing much could be seen at the outcrop, as it had evidently been sunk on to a shallow depth and the pit was full of broken rock. At the end of the crosscut a sheared fracture was encountered, which was drifted on for 127 feet in a direction of S. 37° W., at the end of which there is a shallow winze, now full of water. The drift follows the fracture, which is filled with crushed country-rock and in which no quartz was visible. At only one place was a small lens of crushed quartz noticed; this was in the floor of the drift on the foot-wall side. A sample across 18 inches ran: Gold, 3.76 oz.; silver, 3 oz. to the ton. Another sample taken across the roof of the drift near the winze gave negligible results.

Several open-cuts on the adjoining claim, the *Good Hope Fraction*, indicate the continuation of *Pilot* fissure to the south-west. The greatest width exposed is 2 feet of quartz, with 6 inches of gouge next the hanging-wall; here samples of both the quartz and gouge gave negative results; while at another open-cut 50 feet to the south-west, in which a width of 20 inches of crushed quartz is exposed, the following values were obtained: Gold, 3.2 oz.; silver, 3.5 oz. to the ton. The ore occurs in small quartz-lenses, between which the vein is squeezed to a width of a few inches, and from the above results the values are irregular.

Good Hope.—The vein on this claim has been traced for a considerable distance along the hillside by a number of open-cuts. While persistent in strike, it is similar in character to the above mentioned, to which it lies parallel at a distance of about 300 feet to the north-west.

The underground work consists of a 100-foot crosscut driven from an elevation of 6,700 feet. From the end of the crosscut a shaft said to be 130 feet deep has been sunk on the vein and 207 feet of drifting in a south-westerly direction. The shaft was not examined as the old ladder-ways were not considered safe, but a sample taken across 16 inches at 10 feet below the collar ran: Gold, 0.8 oz.; silver, 2 oz. to the ton.

In the drift the vein shows a width of about 18 inches for a distance of 45 feet from the shaft; for the balance of the tunnel it is nothing but a seam. A sample taken at 45 feet from the shaft across a width of 15 inches gave the following returns: Gold, 0.8 oz.; silver, 2 oz. to the ton. A grab sample from a small dump at the portal of the tunnel gave negligible returns.

On the surface to the east of the crosscut the indications appear more favourable than to the west, yet no underground work has been done in this direction.

There is a small cabin on the claims, situated in a slight sag of the hillside; the only safe place that was noticed by the writer. On account of the steepness and rocky nature of the hillside, transportation of ore can only be solved by a light aerial tram.

As the property stands to-day, the amount of work done is limited, and it is possible that, with further development, sufficient tonnage might be developed not only to warrant a tram, but a small mill near the creek below.

Sheba Group. This group, comprising the *Sheba No. 1* and *Sheba No. 2*, is owned by W. Dowling, of Ymir, and is situated about 2 miles south of Ymir on the west side of Salmo River. Several old shafts and tunnels now completely caved and filled in mark the earlier developments on the lower slopes of the hillside, above which an open-cut and an incline shaft were the only workings that could be examined and the only place where the vein is exposed.

The vein-filling consists of calcite and quartz, with small bunches of ore, consisting of a mixture of galena, zinc-blende, and iron pyrites. At the side of the open-cut just below the surface a small seam filled with oxidized material and carrying a little finely crystalline galena and grey copper ran high in silver values; a sample giving the following results: Gold, 0.06 oz.; silver, 438.1 oz. to the ton. An incline shaft sunk at the end of the open-cut to a depth of 47 feet on the vein discloses it to be narrow and filled with quartz and calcite, with occasional bunches of ore.

As the vein strikes into the hill in a north-easterly direction, good depth could have been gained by an adit driven along the strike, which would have been the better way in which to prospect it. The formation consists of highly altered rocks of the Rossland volcanic series.

On another vein, situated at a distance of about 600 feet in a direction of due east from the above-mentioned workings, development-work consists of a tunnel driven along the strike for 56 feet. The vein is a well-defined quartz-filled fissure in augite porphyrite, having a strike of north and south and a dip of 45° to the west; its width varies from 12 to 20 inches. The quartz is heavily mineralized with iron sulphides where there has been transverse fracturing. A sample taken from the most highly mineralized section of the vein, at a point 30 feet from the portal, unfortunately only gave negligible returns. At 100 feet lower down the hill an old dump marks the location of other workings, now completely caved in, and quartz on the dump signifies that the vein had been encountered.

Among other activities, a little work was done on the *Mayblossom*, situated at a short distance to the south-west of Ymir, and also on the *Jubilee*, situated on Porcupine creek.

On Boulder creek L. R. Clubine put in a season's work on the *Broken Hill* group. A small cabin was built and about a mile of trail connecting the workings with the main trail up the creek. The principal work consisted of a tunnel driven for 35 feet to explore a sheared zone in which small pockets of silver-lead-zinc ore had been uncovered by surface diggings. The tunnel had not been advanced far enough to reach its objective, and, it is understood, work will be resumed next season.

Further work was done by O. Poulin at his property, the *Commodore* group, on Wilkhorse creek.

HALL CREEK.

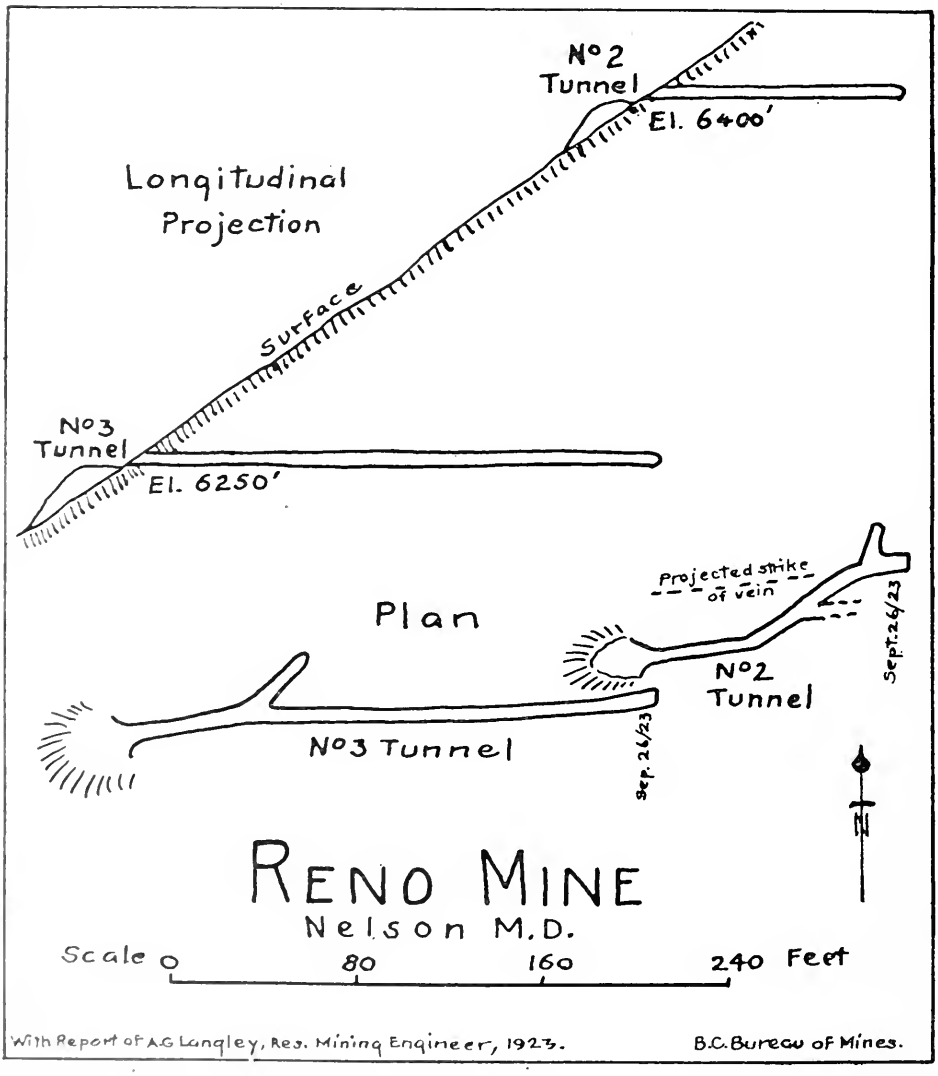
Further development was carried on at the *Golden Age* group, owned by E. and S. Terzian, who, in order to obtain capital for development, organized a company called the Golden Age Mining Company, Limited, of which a prospectus has been issued. The proposed capital of the company is $500,000, divided into 500,000 shares of par value of $1 each. The minimum subscription necessary for this company to commence business, under the "Companies Act, 1921," is stated to be 100,000 shares at 25 cents each. Whether the stock has been subscribed for to the amount stipulated, was not known at the time of writing.

It is understood that W. S. Hawley and associates, of Spokane, acquired the *Fern* mine and had a small crew of men working during the summer. This is an old property which was

operated successfully as early as 1897. It is equipped with a 10-stamp mill. The ore is gold quartz, which, in the oxidized zone, is said to have been amenable to amalgamation, but became refractory at depth. For a full description refer to Memoir 94 of the Geological Survey.

SALMO AND SHEEP CREEK.

The Nugget Gold Mines only had a few men employed at its property, no attempt being made at large-scale operations. It is understood that the affairs of the company are now in



good shape and there is ore in reserve ready for mining and milling as soon as more capital is available for operating purposes.

At the *Kootenay Belle* a small crew of men was employed during the earlier part of the year under the direction of H. Lakes, and a shipment of 28 tons of gold ore was made to Trail.

The Yellowstone Mining Company, of Victoria, which had the *Queen* mine under option, made improvements to the mill and unwatered the shaft. Unfortunately, at the time when the mine and plant were about ready for operation a close-down was forced owing to lack of capital.

A shipment of 223 tons was made from the *Emerald*, but little development was attempted. The property has a good record and is backed by strong interests, who, it is understood, are contemplating a more vigorous campaign of mining and development in the near future.

Reno.

As frequent references have been made to this property in previous reports only a brief summary will be given of the progress made during the year. The No. 3 (or lowest) tunnel was cleaned out and advanced, making its total length 287 feet. To a point within about 15 feet of the face this tunnel is in broken ground lying on the hanging-wall side of a 45° fault plane which dips with the hill to the west. Past this fault the formation, consisting of quartzite, is in place.

At the time of examination in the fall no ore had been encountered on this level except occasional fragments of broken quartz, about 1 ton of which had been extracted. A survey showed the face of the tunnel to lie 10 feet to the south of the portal of No. 2 level, 150 feet above. At this time M. O'Donnell, who was the only man working, was advised to crosscut from the end of the No. 3 tunnel to the north, which he did, and, according to his report, struck the vein in 25 feet. Here it is described as being equally as strong as in the No. 2, where it carries good gold values across a width of over 3 feet.

On the *Donnybrook* claim further work, consisting of trenching and a little tunnelling, has exposed a strong quartz vein having a width of about 3 feet and persistent for a considerable distance. The average values are not as high as those on the *Reno* vein, although the little work so far done indicates possibilities for the development of a considerable tonnage of milling-grade ore.

In the area lying between Salmo and Kootenay lake, commonly referred to as the "Bayonne district," about the usual amount of prospecting activity was reported. The Laib Bros. put in a season at their property, the *Spokane* group. Frank Aikens continued development-work on his properties near the head of the West fork of Summit creek. At the *Bayonne* mine work was discontinued early in the year by J. White and associates, of Spokane, who financed the driving of the long tunnel to tap the vein at greater depth.

At the *Ivo Fern*, on Cultus creek, work was prosecuted with during the greater part of the year by the Standard Silver-Lead Company under option from the owner, J. Mulholland. According to recent advice the company has stopped work at this property.

Quite a nice showing is reported to have been uncovered when building the wagon-road south of Salmo to the boundary. P. Gallagher, of Nelson, and several others are interested, but little information is available at the time of writing.

Alexander McKesson continued development-work at his property on Salmon river at a short distance south of Salmo. The values are in gold, silver, and arsenic.

F. Larsen spent a season placer-mining on Lost creek near the main road. The results of his work proved that, while the gravels carried gold, it was not in sufficient quantity to mine profitably by small-scale methods.

At the *Trillion*, on Lost creek, a little work was done by L. R. Clubine. The property is situated at a distance of 10½ miles by wagon-road from Salmo. The work done consists of a tunnel driven into the base of a bluff just above the level of the creek. Its length is 108 feet and direction S. 13° W. Near the portal a small irregular occurrence of silver-lead-zinc ore was sunk on for 15 feet. The ore apparently replaces limestone along a sheared fracture. Indications pointed to the possibility of the ore crossing the tunnel and following a line of shearing south-easterly, in which direction a little work might be done to advantage. Past this occurrence the tunnel does not reveal much evidence of mineralization.

ERIE.

Taft Group.

This property, owned by Mrs. McAvoy, of Ymir, consists of the *Mayflower*, *Taft*, and *Nancy* claims, situated on Erie creek, about 1½ miles by trail from the end of the *Second Relief* mine wagon-road, which is 12 miles from Erie. The workings are on the mountain-side across the river from the *Second Relief* mine, and the elevation of the cabin is about 4,800 or 1,100 feet above the valley below. The formation is granite, which, above the workings, is cut by a prominent porphyry dyke with a northerly and southerly trend.

A small amount of development-work has been done on three quartz-filled fissure-veins which strike up the mountain at varying angles. In these veins gold occurs associated with iron sulphides, with possibly some free gold in the leached and oxidized portions. The most

promising of the veins, and the one which has been most developed, is the "small" or "No. 2 lead," having an average width of 6 or 7 inches. This vein outcrops at 4,920 feet elevation on the *Taft* claim, striking up the hill north-westerly towards the big porphyry dyke which it is supposed to cross on to the *Nancy* claim on the mountain above. The dip is about 45° to the north-east.

The old workings consist of some open-cuts and shallow shafts, now caved and inaccessible. A sample from a small pile of ore on the dump of a trench about 50 feet long assayed: Gold, 1.78 oz.; silver, 0.6 oz. to the ton. A short distance from the outcrop-workings and 100 feet vertically below them a crosscut tunnel has been driven 80 feet, but it is estimated that it would have to go a further 50 feet to encounter the vein.

On the *Sherbrook* claim, at an elevation of about 4,720 feet, there is a quartz-showing 7 feet wide, which is part of what is known as the "big" or "No. 1 lead," which averages about 3 or 4 feet in width, striking up the mountain south-westerly. The dip is not well defined but approximates the vertical. The quartz is only sparingly mineralized with iron sulphides at this point and a sample across the 7 feet gave no appreciable values.

North-easterly from this showing and several hundred feet below it an old tunnel has been driven 90 feet on the strike of the vein without developing any ore, faulted ground apparently having been encountered a short distance in from the portal.

Also on the *Sherbrook* claim and a short distance southerly from the "big lead," at elevations of 4,400 and 4,440 feet respectively, there are two open-cuts in the "new" or "No. 3 lead," which has a westerly strike and approximately vertical dip. In these open-cuts streaks of quartz containing iron sulphides occur in the vein, which is several feet wide; the balance of the filling consisting of iron-stained schistose rock. A sample across 15 inches in the lower cut gave: Gold, 0.35 oz.; silver, 0.5 oz. to the ton.

Rio Tinto Group.* This group, comprising seven claims owned by J. H. McDonald, of Rossland, is reported to have been bonded recently to L. P. Larsen and associates, of Metaline, Wash. The property is situated on the northern side of the Pend d'Oreille River road about 15 miles from Waneta, on the Great Northern Railway, near the United States boundary. The formation, classified as the Pend d'Oreille series, includes schists, quartzites, and limestones. The claims follow the trend of limestone and quartzite bands which are highly mineralized in places. The strike of these rocks is north-easterly from the river-level, at 1,600 feet above sea-level, up a gentle slope and over the summit of a ridge (elevation 3,000 feet) to a point on the Salmo River slope (elevation 2,580 feet).

The mineralization, apparently of the replacement type, conforms to the bedding of the rocks, which dip from 40° to 50° to the south-east. A number of open-cuts along the outcrop show lead, zinc, and iron sulphides disseminated through the rocks, chiefly in the limestone. The degree of the mineralization varies considerably and the strongest showings are near the river between the low-water level and the wagon-road. Here the mineralization extends over a considerable width for an indicated length of several hundred feet. In places the zinc sulphides predominate and elsewhere the lead sulphides are most in evidence, while at other points the sulphides are intimately mixed. The silver values seem to be low, but extensive and systematic sampling would be necessary to determine even approximately the milling values to be expected.

It is reported that the prospective purchasers intend to develop the property and investigate the character and continuity of the deposits with a view to operations on a large scale. The recent connecting-up of the Pend d'Oreille River road with the new Ymir road near the International Boundary will facilitate the bringing-in of the necessary machinery which the purchasers are reported to have at Metaline.

Leadville Group. This group comprises seven claims located on Goat river at a distance of 7 miles from Kitchener, the nearest shipping-point. The property is owned by the Leadville Mining Company, of Spokane, of which J. J. Underwood is secretary. The formation is composed of thinly bedded quartzites, striking east and west and dipping at 20° to the north. In close proximity to the contact of a large intrusive mass of dark-green basic rock (tentatively classified in the field as diabase) a small quartz-filled fissure cuts the quartzites on the dip, but coincides in strike. The vein can be seen crossing the bottom of Goat river, which no doubt led to its discovery. Above the river there is a high bank of gravel in which futile efforts were made some years ago to prospect the vein by shaft-sinking.

The work done by the present company has been confined to the outcrop in the low-lying rocks along the side of the river. This consisted of digging a deep trench along the strike of the vein and continuing with a 53-foot tunnel along the bed-rock into the gravels of the bank. The result has been to uncover the vein for a distance of about 75 feet. So far the ore-occurrence has been pockety and consists of galena and zinc-blende in a quartz gangue. A lot-on pile of ore extracted from these workings nessled sorting and cobbing to obtain a shipping product. A sample of ore sorted from this pile ran: Gold, 0.04 oz.; silver, 7.5 oz. to the ton; lead 20.3 per cent.; zinc, 10.2 per cent.

It was the intention of the company to continue work during the winter by sinking a winze at the end of the tunnel in order to explore the vein at greater depth before the high water in the spring would interfere with the operations.

Three or four men who had stock in the company were employed and the work was being carried on conscientiously without any unnecessary overhead expense. A good cabin with a large open fireplace afforded comfortable quarters for the small crew.

George Young, of Creston, who put in a season in the hills near Kitchener prospecting the extension of the hæmatite-iron-bearing zone, reported having made further encouraging discoveries.

LIST OF PRODUCING MINES, NELSON MINING DIVISION, SHOWING TONNAGE SHIPPED

Mine.	Locality	Weight.	Character of Shipment.
		Tons.	
Emerald	Salmo	223	Lead-silver ore
Kootenay Belle	Salmo	28	Gold ore
Granite-Poorman	Taghum	2[illegible]	Gold ore
Molly Gibson	Kokanee creek	72	Silver-lead ore

SLOCAN MINING DIVISION.

SANDON AND VICINITY.

Conditions were better in the Slocan this past year than they have been for a number of years. Sandon took on an air of prosperity; old buildings were painted to look like new and every house and shack in the famous old camp became occupied.

Besides the activities of the mining companies, there have been quite a number of men in the hills, leasing and prospecting.

Slocan Star. This mine, owned and operated by the Silversmith Mines, Limited, was the largest producer of silver-lead-zinc ore in the Province, with the exception of the *Sullivan* mine. Operations were continuous during the year, giving employment to an average number of 98 men. According to information received from the president of the company, considerable surface work was done during the year in the way of trenching and sinking test-pits. Underground development included advancing the 1,440-foot level east for a distance of 651 feet and the cutting of a station for sinking on the downward continuation on the old *Slocan Star* ore-shoot.

During 1923 there were 37,805 tons of ore mined, of which 304 tons were shipping-ore and 37,501 tons milling-ore. This milling-ore produced 4,574.04 tons of lead concentrates averaging 100 oz. in silver to the ton and 60 per cent. lead, and 3,159.65 tons of zinc concentrates averaging about 40 oz. in silver to the ton and 50 per cent. zinc.

Prospects for 1924 are considered good, as additional ore is reported to have been blocked out in the *Silversmith* shoot, while conditions in the east part of the mine are promising for further tonnage.

The company has not experienced any trouble from labour or labour shortage and the conditions at the mine and mill point to competent management. During the year $150,000 has been paid in dividends, making a total paid from 1920 to date of $275,000.

Wonderful. This mine, owned and operated by Clarence Cunningham, has experienced a successful year, as will be seen from the following: During the period from May 1st to December 24th, 10,093 tons were mined, from which 702 tons of lead concentrates yielded 61,530 oz. of silver and 846,775 lb. of lead, and 923 tons of zinc

concentrates yielded 59,074 oz. of silver, 205,077 lb. lead, and 625,313 lb. of zinc; in addition, 100 oz. of gold.

Ruth-Hope.

This property, comprising thirteen Crown-granted claims, was acquired under option by R. H. Stewart and associates in August, 1922, from which date mining and development work has been undertaken with encouraging results; the ore extracted having contributed to a large extent towards paying all expenses. In order to carry on more extensive development, which conditions appear to fully justify, it was necessary to obtain more capital, and with this object in view the Ruth-Hope Mining Company, Limited, of Vancouver, was incorporated in April, 1923. The prospectus inviting subscriptions to the stock gives a clear conception of conditions and possibilities of the property. During the year, besides surface exploratory work, extensive underground development was accomplished under the supervision of R. H. Stewart.

The *Ruth* No. 2 vein, the outcrop of which was discovered at about 150 feet above the uppermost (or No. 1) tunnel of the *Ruth* workings, was opened by an adit-tunnel driven 125 feet along the strike. This discloses a nice shoot of ore, which was being stoped below the level. The ore in this stope is a high-grade silver-lead ore, occurring in lenses running from the hanging-wall to the foot-wall and separated by highly crushed and oxidized vein-matter. Here, according to R. H. Stewart, crude ore to the amount of $30,000 has been extracted from a vein area of 30 by 50 feet. At the westerly end of this ore-shoot faulted ground was encountered, through which an incline shaft was being sunk from the surface to pick up the continuation of the ore at depth.

It is reported that ore has recently been struck in this shaft (now down 190 feet), where crosscutting has revealed the vein to have a width of 12 to 27 feet. This vein was originally opened on the No. 4 level of the *Ruth*, where it is claimed ore was extracted over a length of 400 feet, but stoping was only continued for 50 feet above the level. So the section of 550 feet on the dip of unprospected ground between the *Ruth* No. 4 and the upper workings offers good possibilities. Beyond these limits not enough development has been done at depth, or in the direction of the easterly and westerly extension of the vein, to justify an opinion as to what might be expected. Besides the encouraging results obtained in this new area, the old workings in many places suggest possibilities which warrant further exploratory work.

In this connection recent work consisting of a 90-foot intermediate drift driven 90 feet below the No. 3 level exposes a good average width of milling-ore. The development, however, which is considered of paramount importance by the company and which will involve a considerable expenditure, is the driving of a 2,200-foot crosscut from the *Ruth* No. 5 level to strike the probable continuation of the *Silversmith* vein on the *Blue Grouse* claim. This crosscut will also prospect an area which suggests other possibilities.

Queen Bess.—No shipments were made from this property, but development carried on during the season aggregated about 300 feet of tunnel-work. It is reported that this has shown up a fair grade of milling-ore, but further work is necessary to ascertain the true character of this deposit.

Idaho-Alamo.—A small amount of development was performed on this property, but no new disclosures resulted.

Sovereign.—A shipment of 33 tons of crude ore was made from this property, the contents being 1,994 oz. of silver and 32,193 lb. of lead.

Surprise.—Leasers working at this property made a shipment of 52 tons to Trail.

Monitor.—George Gormley, of Sandon, worked this property under the terms of a lease and shipped 66 tons of silver-lead ore.

Gem.—M. Byrne continued his silver-lead placer operations and shipped 15 tons to Trail.

Victoria.—This mine, situated on the northerly side of Carpenter creek at a short distance above Sandon, was operated by Spokane interests. The work was confined principally to continuing the low tunnel.

Reco.—J. M. Harris, one of the principal owners, had a small crew of men employed at exploratory work.

Carnation.—Further development of the property was carried on under the direction of George Clark, of Sandon.

Cinderella.—Situated near Three Forks. Several men were engaged in prospecting at this property during the season.

Hinckley.—R. A. Grimes acquired this property under bond and had several men working during the season.

Rambler-Cariboo.—Work was resumed during the summer with a small force of men and 9 tons of ore was shipped.

Lucky Jim. According to reports, this mine has been acquired by A. G. Larson and associates, of Spokane. The mine has had a long and interesting history, being discovered in 1892 and first worked for silver and ore. Since those early operations it has been worked intermittently, governed to a large extent by the metal market fluctuations, but has a large production of zinc ore to its credit. During the Great War it was successfully operated by A. G. Larson and at this time ranked among the most important producers of the district.

Victor Group. Situated on the westerly side of Carpenter creek between Three Forks and Sandon. The vein was discovered in 1892 and is referred to in the Annual Report of that year. The upper tunnel, which gains a depth of from about 50 to 60 feet below the outcrop, has been driven for a distance of 150 feet. From this level the ore has been stoped over a length of 50 feet and to a height of about 40 feet. In this stope the ore-streak of massive galena, varying in thickness from a few inches to about 10 inches, lies next the hanging-wall in soft oxidized ledge matter. The apparent hanging-wall, which is highly mineralized and decomposed by oxidation, suggests further ore possibilities on this side of the vein.

The vein has a strike of N. 35° E. and a dip of 65° to the north-west; this latter is unusual as nearly all the fissures in the Slocan dip in the opposite direction, and it is possible—in fact probable—that the permanent dip will be found, on further development, to be to the south-east. To develop the vein at greater depth another tunnel was being started from a point 100 feet lower down the hill.

The owner stated that 60 tons of ore shipped last winter gave net smelter returns of about $12,000. The development-work is being prosecuted with cautiously and systematically by a small crew of men.

McAllister. Situated on the Kane creek within a few miles of Three Forks. The long crosscut driven at a vertical depth of 342 feet below the upper workings was continued during the year. Unfortunately this tunnel failed to intersect the downward continuation of the vein, although it extended well past the calculated point of intersection. Recent reports state that the vein was eventually picked up by raising 100 feet, where good ore was encountered, and this is now being drifted on.

Canadian Group. This property, consisting of a group of four claims and a fraction, namely, the *Adams*, *Brandon*, *Katie B.*, *Sarah B.*, and *Hilltop Fraction*—is located in the summit country forming the divide of Carpenter and Silverton creeks. J. Brandon, of Sandon, one of the principal owners, is acting as agent for the claims and during the year leased the No. 1 tunnel workings to A. McGilvray and Neil McMillan, of Sandon, while A. Jarvis and several others were granted a lease on a parallel vein farther to the west. The trip to the property was made in order to decide whether conditions warranted the construction to the No. 1 tunnel, and unfortunately time did not allow an examination of abandoned workings lower down the hill.

The cabin is situated in the basin at an elevation of 6,400 feet. The vein cutting the slates of the Slocan series strikes N. 10° E. and dips at an angle of 70° to the east. The No. 1 (the uppermost) working, situated at an elevation of 6,660 feet, has been driven into the summit ridge for a distance of about 250 feet, and if continued much farther would strike out on the southerly side of the divide.

The surface showings on the precipitous and rocky hillside above the tunnel are somewhat unique, for the action of erosion has worn away the vein filling to leave a fairly deep and open channel to the summit, which latter is 250 feet above the tunnel.

The tunnel does not follow the vein for its entire length, but lies partly in the foot-wall and partly in the hanging-wall; evidently this fact was not recognized when it was driven, for at the time of the writer's visit the leasers had succeeded in uncovering several fine showings on the west side of the tunnel, where the vein showed a width of about 5 feet.

The vein-filling consisted of streaks and bunches of galena and zinc-blende in a soft decomposed gangue highly stained with oxide of iron and containing some carbonate ore which carried good average values in silver and lead. A sample of sorted ore for shipment ran as follows: Silver, 94.6 oz. to the ton; lead, 45.1 per cent.; zinc, 10.8 per cent. A sample of sorted zinc ore ran: Silver, 63.3 oz. to the ton; zinc, 40.2 per cent.

Nearer the portal of the tunnel ore was being stoped at a height of 70 feet above the level. Four men were employed in these workings and the prospects for winning at least a car-load before snowfall appeared good.

On the southerly side of the summit a short tunnel has been driven on what is known as the No. 2 vein. Ore shows in the portal, but has been cut off by a fault at a short distance in. The amount of work done here is not sufficient to determine the possibilities.

American Boy.

This property is among the old locations of the Slocan and, as it was referred to in last year's report, only a few brief remarks will be submitted. At present it is being operated by the American Boy Mining Company, of which John Vallance, of New Denver, is superintendent. At the time of the writer's visit development was being carried on by a small crew of men at the No. 7 (or lowest) level. During the early part of the year a new bunk-house was completed, which provides excellent accommodation for about twenty men and is conveniently situated to the workings.

The No. 7 level has been driven into the hill at an elevation of 5,800 feet and consists of a 250-foot crosscut to the vein. From the end of this crosscut the vein has been followed for a considerable distance by drifting. It has a north-easterly strike and dips at a steep angle to the south-east. Its width on this level is about 2 feet. The vein-filling consists of crushed material between well-defined walls; conditions suggest that it has been formed in a fault-fracture along which there has been a shearing movement.

At a point 300 feet from the crosscut a shaft was being sunk near the intersection of the main vein and a cross-fissure, the latter having a strike of N. 10° E. This shaft was down 50 feet and showed a little ore coming in at the bottom.

In a 23-foot intermediate tunnel driven from the shaft at a short distance below the level a small lens of ore was exposed lying next the hanging-wall. Its maximum width was about 18 inches and a general sample taken across its width and along a length of 10 feet ran as follows: Gold, 0.02 oz.; silver, 96.1 oz. to the ton; lead, 69.5 per cent.; zinc, 6.4 per cent. Work at the bottom of the shaft was being continued and conditions appeared to justify further exploratory work in this part of the mine.

R. E. Lee.

Situated on the summit of the divide between Carpenter and McGuigan creeks. The property, which has been lying idle for a number of years, was being worked under a lease by R. C. Morton and W. S. McLanders, of Sandon. It is principally owned by George Alexander, of London, whose local representative is James Anderson, of Kaslo. A trail connecting the upper workings with the *Last Chance* trail was built to allow the packing-in of supplies and the "go-devilling" of ore. The only building on the property is a small cabin occupied by the leasers, which is situated near the summit at an elevation of 7,150 feet.

The formation underlying the summit area is composed of slate which has been intruded by granite-porphyry dykes. The vein outcrops along the bluffs forming the northerly side of the summit ridge, striking N. 70° E. and dipping at an angle of 50° to the south.

The leasers were confining their attention to shallow surface diggings along the outcrop, where streaks and small pockets of galena occurred along the hanging-wall and which apparently had been overlooked when the property was worked many years ago. The vein, which showed a good average width for mining purposes, was filled in, in the zone of oxidation near the surface, with soft decomposed ledge-matter stained with iron oxide. An old tunnel which had been driven along the vein for a considerable distance encountered the ore-shoot, as exposed on the surface, at a distance of 90 feet from its portal and at a depth of about 50 feet; as this piece of ground had not been stoped out, it offered possibilities for winning a small tonnage of high-grade silver-lead ore. Old abandoned tunnels on either side of the summit were not examined. At the time of the writer's visit about 10 tons of ore had been extracted and sorted for shipment; a grab sample of this ran: Gold, 0.02 oz.; silver, 143.1 oz. to the ton; lead, 69 per cent.; zinc, trace.

Trail—Town and Smelter

Rossland—Town and Mines

It may be of interest to note that the new trail to this property, coming in at the summit with an old trail to the McGuigan basin, thus giving easy access from Sandon to valuable properties on the northerly side of the summit.

Washington. This property, owned by the Washington Mines Limited, of which W. H. Burgess, of Kaslo, is secretary, is situated on the north-easterly side of Payne mountain and at no great distance in an easterly direction from the *Payne* mine. The mine, which was worked as early as 1892, has a considerable production to its credit but has been lying idle during recent years. A 50-ton concentrator was built in 1895 for the treatment of the second-grade zincky ore. This was the first concentrator to be erected in the Slocan, but to-day there is only enough of it left to tell where it once stood.

This year O. Sunberg and A. Jarvis, of Sandon, took a lease on the property and succeeded in winning about 40 tons of silver-lead ore from the old workings on the No. 1 level. This ore averaged: Silver, 114 oz. to the ton; lead, 73 per cent.; zinc, 7.5 per cent.

The vein strikes south-westerly into the mountain, dipping at an angle of about 75° to the south-east. Its width varies, but would average about 5 feet. The country rock, consisting of slates and carbonaceous limestones of the Slocan series, has been intruded by porphyry dykes, one of which lies close to the vein in places. The vein has been developed by four adits driven into the northerly side of the hill.

As only a cursory examination was made, a description of the workings will not be attempted, but from what was seen in the No. 1 tunnel it was evident that the bulk of the tonnage had been mined from the first few hundred feet of ground, when the vein was cut off by fault movements which have left a zone of sheared and slickensided graphitic slate.

Although considerable work had been done beyond the fault, no further ore-body of importance had been developed. Still the property is located in a highly mineralized area extending westerly to the *Slocan Boy* and the *Payne*, and one which would appear to be worthy of detailed geological-survey work in an endeavour to gain information regarding faulting and structural conditions with a view to determining the nature of further exploratory work.

Soho Group. This group comprises the following claims: *Tom Moore*, *Liberator Sodie*, *Soho*, *Northern Pacific*, *Red Cross*, *Boxer No. 2*, *Faraway No. 2*, and two fractions.

The property belongs to the Soho Mines, Limited, with the registered office at Spokane. J. C. Ryan, the manager, who has been interested in this and other properties in the Slocan for many years, informed the writer that his company expected to reorganize shortly for the purpose of obtaining additional capital to carry on extensive development work. The property is easily accessible from the *Rambler Cariboo* wagon-road, from which a good trail leads for a short distance to the workings.

The camp, consisting of two small cabins, is situated at an elevation of 6,750 feet and near the portal of the lower tunnel on the *Tom Moore* claim, where most of the work has been done. The formation, consisting of steeply tilted slates and limestone, has been greatly disturbed by intrusions of quartz-porphyry dykes.

The vein on which most of the work has been done, and known as the *Tom Moore* vein, occurs in a steep narrow ridge between the two branches of McGuigan creek. It has a strike of N. 40° E. and dips at an angle of 75° to the south-east into the hill. It has been developed by five levels driven in the westerly side of the ridge, which explore the vein for a depth of about 350 feet below the outcrop. The ore formerly shipped from the property, reported to have had a total value of about $20,000, was extracted from the upper levels, all of which are not now accessible. In the No. 4 level, which is 80 feet above the lowest or No. 5 level, a small shoot of zincky ore is exposed along the bottom of the drift, and work was being done to explore the ground under this showing from the latter level.

Some 500 feet of drifting on the vein in the No. 5 level proved it to be [illegible] too small to work profitably. However, at the easterly face of the drift, which was [illegible] a point below the showing on the level above, the ground was beginning to [illegible] pockets of galena and zinc-blende indicated encouraging possibilities. A sample taken from a small pile of ore extracted from the face of this drift ran: Gold, [illegible]; silver, [illegible] oz. to the ton; lead, 46.4 per cent.; zinc, 24.5 per cent.

On the other side of the hill a small vein known as the *Ryan* vein has been explored by a drift from the surface about 180 feet long. The strike of this vein is north-easterly and dip 38° to the south-east. The vein has been formed along a sheared fracture in limestone near

the contact of slate-schist. The drift, which follows the vein for a distance of about 90 feet, terminates in a quartz-porphyry dyke. At a point where the mineralization showed greatest strength a 35-foot shaft had been sunk, from which a small shipment of high-grade silver ore is reported to have been made.

A 25-foot drift driven from the bottom of this shaft showed the vein-filling to consist of fine-grain galena, zinc-blende, and iron pyrites disseminated through a quartz gangue, and occasional streaks of finely crystalline zinc-blende associated with silver sulphides and ruby silver. A sample from a 3-inch streak of this high-grade ore ran: Silver, 120.8 oz. to the ton; zinc, 25.4 per cent.

Other workings on the property include a 100-foot shaft sunk on the *Soho* claim at a distance of about a quarter of a mile in a northerly direction from the above-described workings. This shaft, which was sunk many years ago, could not be examined on account of water, but judging from the old dumps the ore encountered consisted of a mixture of galena, zinc-blende, with iron pyrites and spathic iron, and was essentially of milling grade. This vein, known as the Soho vein, has a strike of N. 60° E., but as the old workings were inaccessible not much information could be gathered regarding the possibilities, but conditions appeared to warrant further exploratory work being done from a point lower down the hill, near the wagon-road.

Dublin Queen.

This is one of a group of claims owned by the Jackson Mines, Limited, of which James Anderson, of Kaslo, is agent. Other claims of the group are the *Northern Belle*, *Ophir*, *Kootenay Star*, *Labor Day Fraction*, and *Congress*. Recent prospecting on the *Dublin Queen*, at an elevation of 6,700 feet, by means of open-cuts has disclosed a small but persistent vein in a slate formation and having a strike of N. 60° E. and a steep dip to the south-east.

In the precipitous peaks of the summit country overshadowing the Jackson basin to the west, where the formation is freely exposed, intrusions of numerous quartz-porphyry dykes are a striking geological feature, and if these dykes bear any relation to the mineralization this area certainly should be a rich one. In this particular case dyke-rock is in evidence, lying next to the vein in some of the open-cuts.

The work done exposes the vein along the strike at intervals for about 300 feet. Near the westerly end, where there is evidence of cross-fracturing, the indications appealed to the writer as being promising for developing a good width of ore. At other open-cuts the vein was small and showed a streak of a few inches of galena in oxidized gangue material carrying some carbonates. A sample taken of a small quantity of ore extracted from these cuts ran: Gold, 0.02 oz.; silver, 70.8 oz. to the ton; lead, 59.2 per cent.; zinc, 2.6 per cent.

At the easterly end a 50-foot crosscut was run many years ago. This tapped the vein, which was drifted on for a distance of 90 feet in an easterly direction and 20 feet in a westerly direction from the crosscut. This tunnel gains very little depth and does not disclose any ore which could be mined profitably.

As the vein outcrops along a fairly flat portion of the hillside, no appreciable depth can be gained except by driving a long crosscut tunnel, which present conditions do not appear to warrant. However, further exploratory work may reveal sufficiently important showings to warrant work of this nature possibly being undertaken from the old workings of the *Jackson* mine, which are situated lower down the hillside.

These old workings, which were being cleaned out and retimbered to allow access for examination, are very extensive, there being altogether about 3,800 feet of tunnelling from five adit levels and 700 feet of raises and winzes. The mine is quoted in the Zinc Commissioners' report of 1906 as having produced 2,000 tons of lead ore, about half of which was hand-sorted, the remainder being lead concentrates averaging: Silver, 58 oz. to the ton; lead, 60 per cent.; zinc, 12 per cent.; and 1,200 tons of zinc concentrates averaging: Silver, 10 oz. to the ton; zinc, 38 per cent.; lead, 2 per cent.; iron, 15 per cent., the iron being chiefly as carbonate (siderite).

The mill, which is still standing, was built in 1898 and has a capacity of 4 tons an hour. The equipment consists of a crusher, two sets of rolls, seven jigs, and two Wilfley tables, with the necessary screens and hydraulic classifiers. The mine-workings were not open at the time of the writer's visit, but a full description of same by Philip Argall may be seen in the Report of the Zinc Commission of 1906. A wagon-road of excellent grade leads from the mill to the railway at Whitewater, the total distance being 5½ miles.

Mascot. This property is situated on Tributary creek at a distance of about 2 miles from Sandon. During the season it was being worked under the terms of a lease, under the direction of Joe Johnson, a well-known [illegible]. The formation, consisting of slate, has been fractured and faulted, indicating that the small pockets and lenses of silver-lead-zinc ore occurring in this broken ground may possibly belong to a ledge farther in the hill.

To explore the ground below the surface exposures of ledge-matter and the upper workings from which a small tonnage of good grade silver lead is said to have been extracted, a crosscut tunnel has been driven into the hill for 160 feet and in a direction of S. 30° E. At the end of this tunnel a little ore was encountered lying next the wall of a slip. From this point drifting has been done in a westerly direction for 156 feet, at the end of which a crosscut was being driven to strike the possible continuation of the vein.

Although the work done at the time of the writer's visit did not disclose ore in any quantity the indications apparently fully justified further prospecting, especially as the property lies in a well-mineralized area.

NEW DENVER SECTION.

Bosun. This property was operated steadily during the year with a crew of twenty-seven men. The net smelter returns for lead and zinc shipments for the year total $53,500. J. P. MacFadden, general superintendent, reports that the development accomplished has been the advancement of the lower (or No. 6) tunnel and an intermediate 80 feet above for a distance of 350 feet. Both the above pieces of work especially the lower, exposed some promising lenses of lead and zinc ore equal to that mined above, and stoping is just being commenced. In the intermediate level a stretch of galena 15 inches wide and 12 feet long displayed an exceptionally rich deposit of grey copper.

Molly Hughes. Development and mining has progressed steadily during the year with a crew of about seven men. According to recent reports, the work consisted of 123 feet of sinking, as follows: 78 feet in No. 1 winze, 25 feet in No. 2 winze and 20 feet on the surface. A shipment of 46 tons from No. 1 winze yielded a total value of 6.9 oz. in gold and 5,441.75 oz. in silver. Twenty-eight tons was shipped from other parts of the mine.

New plant installed during the year comprised two 40-horse-power Fairbanks-Morse oil engines, a compressor having a capacity of 314 cubic feet of free air a minute, a No. 5 Cameron sinking-pump, machine-drills, etc.

NOTE.—The annual report for 1922 read: "A total of 4 tons shipped during the year averaged the following values: Gold, 10 oz.; silver, 1,884 oz. to the ton." This was a typographical error; the values given were the total contents of the shipment of 4 tons.

Mountain Chief.—Mining operations were carried on during the year by F. Edwards and C. C. Clifford. A car-load of ore was shipped to Trail.

SILVERTON.

Standard. W. H. North, the manager, reports that the lessees have averaged about twenty men throughout the year. The ore mined totals about 7,[illegible] tons and was mostly a zincky milling grade won from the old stopes. No new developments of any importance are reported. The shipments consisted of 362 tons of lead concentrates and 1,581 tons of zinc concentrates.

Mammoth. This is a new prospect which the Standard Silver Lead Mining Company took under option at the beginning of the year and developed during the season. Work was stopped recently owing to the company not being able to conclude satisfactory arrangements with the owners. The property is referred to in last year's report as the *Monarch* group.

Van Roi. Owned and operated by Clarence Cunningham. The property has made a very satisfactory showing for the year. Ore mined and shipped as lead and zinc concentrates amounted to 3,798 tons, containing 23,801 oz. of silver, 271,[illegible] lb. of lead, and 328,351 lb. of zinc.

Hewitt. M. S. Davys reports that he has been opening up the mine under the leasing system and has about twenty leasers working in different parts. The work accomplished is said to have shown up a considerable tonnage of both high

grade and milling ore between the No. 8 tunnel and the surface, while other parts of the mine also present good possibilities. He states that during the year the leasers shipped about 134 tons of high grade and have about 1,000 tons of milling grade, which is now being treated. It is anticipated that the mill will be able to run one shift through the winter on the ore being broken down by the leasers.

Lucky Thought.—This property, situated near the *Hewitt* and owned by the Consolidated Mining and Smelting Company, has been leased by M. S. Davys, who is putting in a tram from the mine to the *Hewitt* mill.

Galena Farm.—This mine was operated by R. Ainslie, who had a small crew of men working. A small tonnage of ore was milled and shipments aggregating 297 tons were made to Trail. Contents: 4,313 oz. silver; 10,319 lb. lead; 214,792 lb. zinc.

Wakefield.—Work of an exploratory nature was carried on during the year, the same being financed by J. White and associates, of Spokane.

Metallic Group.

This group, situated at a distance of about 3 miles from Silverton and comprising the *Metallic*, *Midnight*, *Mary Florence*, and *North Star*, is owned by R. McFarlane and A. S. McAulay, of Silverton. Since visiting the property in 1918, which was then referred to in the Annual Report as the *Midnight*, a considerable amount of work has been done. The upper tunnel, which has been advanced, exposes a vein strong and persistent in dip and strike for about 300 feet. The ledge matter, which in places has a width of 10 feet, consists of sheared country-rock and includes bunches and narrow bands of ore composed of a mixture of galena and zinc-blende; the silver values being principally associated with grey copper. In recent years leasers have mined and sorted a few car-loads of silver-lead ore from this tunnel, with the result that there is a considerable tonnage of milling-grade ore on the dumps and left in the mine.

Another tunnel driven at some little distance down the hill gains an additional depth of 95 feet on the dip of the vein. This tunnel was just getting into promising-looking ground, from which some 15 tons of ore had been extracted, when the property was visited. A grab sample from this pile of ore ran as follows: Gold, 0.02 oz.; silver, 173.1 oz. to the ton; lead, 23.2 per cent.; zinc, 20.1 per cent.

This deposit and others in the vicinity occur in the Slocan series near the contact of a large intrusive mass of granodiorite in this zone of contact, which extends westerly to Silverton creek, the veins have similar dips and strikes; in this particular case the strike is east and west and the dip 50° to the north. The area has been a productive one and no doubt still has good possibilities.

LIST OF SHIPPING MINES IN SLOCAN MINING DIVISION, SHOWING TONNAGE SHIPPED.

Mine.	Locality.	Weight. Tons.	Character of Shipment.
Silversmith	Sandon	37,895	Silver-lead-zinc concentrates.
Wonderful	Sandon	10,663	Silver-lead-zinc concentrates.
Ruth	Sandon	444	Silver-lead ore.
Canadian	Sandon	55	Silver-lead ore.
Gem	Sandon	15	Silver-lead ore.
Victor	Sandon	60	Silver-lead ore.
Monitor	Sandon	66	Silver-lead ore.
Lone Bachelor	Sandon	35	Silver-lead ore.
Black Colt	Sandon	3	Silver-lead ore.
Elkhorn	Sandon	4	Silver-lead ore.
Sovereign	Sandon	33	Silver-lead ore.
Surprise	Sandon	52	Silver-lead ore.
American Boy	Sandon	32	Silver-lead ore.
Noonday	Sandon	4	Silver-lead ore.
Washington	Rambler	39	Silver-lead ore.
Rambler	Rambler	9	Silver-lead ore.
Soho	Rambler	33	Silver-lead ore.
Bosun	New Denver	1,198	Silver-lead-zinc ore.
Mountain Chief	New Denver	28	Silver-lead ore.
Molly Hughes	New Denver	74	Silver ore.
Standard	Silverton	7,200	Silver-lead-zinc concentrates.
Van Roi	Silverton	3,798	Silver-lead-zinc concentrates.
Hewitt	Silverton	134	Silver-lead ore.
Galena Farm	Silverton	297	Silver-lead concentrates.
Metallic	Silverton	30	Silver-lead ore.
Total		72,204	

SLOCAN CITY MINING DIVISION.

There are no important developments to report from this Division for the year, activities having been confined to prospecting and some small-scale operations. Small shipments of high-grade silver ore were made from the *Anna* (K. Zimmerman), *Meteor* (W. A. Buchanan), *Ottawa* (Pat Maguire), *L.T.* (D. B. O'Neill), and *Pegleg* (formerly the *Neepawa*, owned by Ed. Shannon). The *Pegleg* is on Enterprise creek, all the rest being on or tributary to Springer creek.

At the *Meteor* the development-work done by a small crew under the supervision of George Long was encouraging. In the lower tunnel the vein was drifted on for about 60 feet, showing a high-grade pay-streak throughout, the estimated "backs" on the ore being 180 feet. A 1-drill Laidlaw compressor was installed, power being supplied by a Massey-Harris tractor oil-engine (dismantled).

LIST OF PRODUCING MINES IN SLOCAN CITY MINING DIVISION, SHOWING TONNAGE SHIPPED.

Mine.	Locality.	Weight.	Character of Shipment.
		Tons.	
Anna	Springer creek	6	Silver ore.
Meteor	Springer creek	8	Silver ore.
Ottawa	Springer creek	20	Silver ore.
Pegleg (Neepawa)	Enterprise creek	4	Silver ore.
L.T.	Springer creek	4	Silver-lead ore.
Total		42	

TRAIL CREEK MINING DIVISION.

ROSSLAND CAMP.

The famous old camp of Rossland became rather depressed and quiet when the Consolidated Mining and Smelting Company closed down its mines in April, 1922, but with the resumption of operations in November, 1923, business rapidly began to revive and by the end of the year old-time prosperity had been re-established to a large extent.

The ore mined from the *Centre Star-War Eagle* group is being concentrated at Trail before smelting. By following this procedure the company is able to recover the metallic contents of the ore at a greatly reduced smelting cost. The tonnage being mined at about the end of the year was 300 tons a day. This will probably be increased when all the finer adjustments have been made to the mill flow-sheet for treating a larger tonnage.

It is understood that at present most of the ore shipped is being mined from the 1,750-foot *Le Roi* level at the extreme south-westerly end of the workings. Here a nice shoot of ore some 400 feet long and of good stoping width has been opened up in recent years.

In order to cope with an increased production a number of improvements have been made to the surface plant at the *Centre Star*, including the addition of a large primary crushing plant.

The famous *Le Roi No. 2* mine, which adjoins the *Le Roi* to the west, was acquired by the Consolidated Mining and Smelting Company, and no doubt will prove a valuable addition to the already large holdings of this company.

Small shipments of high-grade gold ore made by the lessees working the *I.X.L.* mine stirred up quite a little excitement and led to other activities in the vicinity.

Trail Smelter. The year has witnessed the completion of additions and improvements to the many different units of the immense plant. An air of efficiency prevails in every department, bespeaking up-to-date organisation. The concentrator formerly used for *Sullivan* ore was adjusted for Rossland ores, which are now being treated at this plant. Around the lead-smelter many improvements have been made in recent years, possibly the most noticeable being the Dwight-Lloyd sintering plant, which has done away with all the ramifications previously necessary to prepare the charge for smelting.

Experimental work in connection with the smelting of copper ores was being carried on with, it is understood, satisfactory results. The output of the plant for the year is approximately as follows: Zinc, 30,120 tons, of which 3,700 tons are from custom ore; lead, 47,800 tons, of

which 5,200 tons came from independent shippers. The silver production is estimated at 2,900,000 oz., 1,700,000 oz. having been purchased.

The company gives employment to about 2,000 men, 1,100 of which work at the above plant.

Giant-California.

This property, consisting of two Crown-granted claims—*California* and *Giant*—belongs to the Cal-Roi Mining Company, of Rossland. The area occupies the south-west slope of Red mountain and is underlain by thinly bedded slates and quartzites of the Mount Roberts formation, which have been intruded by porphyry dykes and tongues of granodiorite. This sedimentary series has been highly altered and pyritized, presumably by metamorphic processes due to the influence of intrusive and underlying masses of igneous rocks.

On the *Giant* claim heavy iron-stained surface exposures indicate the presence of two distinct zones of mineralization, one running east and west and the other following a porphyry dyke in a north-and-south direction. The mineral-bearing solutions have apparently replaced and impregnated the country-rock along lines of least resistance.

The *California* claim, which is located on the lower portion of the mountain-side, adjoins the *Annie* claim of the *Le Roi No. 2* group. The last record of extensive work on this property was that done by the Granby Consolidated Mining and Smelting Company, including a 1,200-foot crosscut and a long drift in an easterly direction, which latter connects with the No. 5 level of the *Le Roi No. 2* by a 300-foot shaft. The main tunnel is in the Mount Roberts formation, and it is thought that better possibilities for ore-development exist in the underlying augite porphyry at an additional depth of from 300 to 500 feet. Further reference to this and other workings on the property may be seen in Memoir No. 77 of the Geological Survey.

The buildings and equipment on the *California* are in a good state of repair, the latter consisting of a Canadian Rand duplex compressor having a capacity of 800 cubic feet of free air a minute and driven by a 150-horse-power electric motor. The buildings include a capacious and well-built compressor-house, blacksmith-shop, and foreman's residence.

Giant.—This claim adjoins the *California* to the north and is reached by following an old wagon-road up the mountain, where, at an elevation of 4,060 feet, the lowest workings are reached. Here there is exposed along the face of a deep open-cut a width of 30 feet of low-grade sulphide ore carrying small values in gold, silver, and copper. It principally consists of finely disseminated arsenical and iron sulphides in siliceous gangue, with a little chalcopyrite, the latter in places being sufficiently segregated to form ore which could possibly be mined selectively at a small profit. Whether the values are sufficiently high to allow mining the whole mass can best be ascertained by sampling on a large scale, preferably with the use of a little powder and steel. It is a strong surface exposure and would appear to warrant careful investigation with a view to development on a bolder scale than has heretofore been undertaken.

Other old workings include a short tunnel and a 60-foot shaft, which latter could not be examined; also a number of open-cuts, which indicate the extension of the mineralized zone for about 150 feet easterly. To the west iron-stained surface showings, traceable for about 1,000 feet, suggest possibilities in this direction; although the greatest concentration of sulphides apparently is localized in the vicinity of the large open-cut.

Following up the hill in a northerly direction along the contact of a porphyry dyke, numerous open-cuts, in which the country-rock is highly impregnated with iron sulphides, indicate a north-and-south zone of mineralization; these lead to the main workings of the *Giant*, from which good ore was shipped in the early days.

As there is nothing much to be seen here now, except the old opening of the glory-hole, the following excerpt from Memoir No. 77 of the Geological Survey is quoted: "The mine has about 500 feet of workings and shipped 4,344 tons of ore before suspending operations in 1903. In 1902, under the management of M. E. Purcell, good results were obtained from ore-treatment and the operating expenses were paid by ore receipts after the shipments were started. The *Giant* ore contains sulphides of cobalt, nickel, arsenic, iron, and molybdenite, all with gold. The average analysis of ore from 100 cars shipped in 1903 was: Gold, 0.9 oz.; copper, 0.1 per cent. . . . The strike of the vein is in a north-and-south direction, with steep dip to the east. The country-rock is Mount Roberts formation and the ore-shoot is located on a contact of pulaskite porphyry (mica-syenite porphyry) at the intersection of co-ordinate fracture-planes striking nearly at right angles. The pulaskite porphyry forms the hanging-wall of the ore-shoot in the upper part of the stope and the foot-wall in the lower."

I.X.L. Shipments of rich gold ore were continued during the year. Not many have been made and the total tonnage shipped has been small; but to offset this the values have been exceptionally high. Some of the sorted ore ran as high or higher than 300 oz. in gold and 75 to 100 oz. in silver to the ton. The low-grade ore, as is usually the case, is pockety, and the expression of one of the lessors regarding the vein that "one day it looks like a million dollars and the next like 50 cents" aptly describes the vein's ore. However, it is undoubtedly a good leasing proposition, which is in all probability a satisfactory way for the owner to have it operated.

The leasers operating the property are experienced miners of the Rossland camp, with whom are associated several engineers of the Consolidated Mining and Smelting Company. Owing to a rather complicated system of faulting, following the vein has been no easy task and involved a considerable amount of exploratory work, which has only been undertaken after a careful study of the conditions, with the result that it is now opened up to the No. 3 level, some 170 feet on the dip, below the uppermost workings. On this level it shows no signs of weakening, its average width of about 14 inches being maintained along an exposed length of approximately 40 feet. The vein strikes east and west and dips at 38° to the south. So far both dip and strike have been persistent, although faulted in a number of places. The vein is of massive and slightly banded quartz in serpentine. The hanging-wall is frozen and the foot-wall is marked by a streak of gouge. The gold, which is plainly visible to the eye, occurs in thin films along the partings in the quartz and also as disseminations; the associated minerals are principally galena and siderite.

The encouraging conditions encountered at depth caused the leasers to clean out and advance the old No. 4 tunnel, situated at 100 feet or more lower down the hill. This was badly caved at the portal and the repair-work was progressing at the time of the writer's visit.

A portable Ingersoll-Rand compressor driven by a 35-horse-power gasolene-engine and having a capacity of 210 cubic feet of free air a minute is used for driving a couple of machine-drills and has been very satisfactory.

O.K. This claim, adjoining the *I.X.L.* to the west, is being worked under lease and bond by H. Gamble and associates, of Rossland. The mine is opened by three tunnels, representing in all about 1,000 feet of underground workings. According to old reports, most of this work was done between the years 1893 and 1896. In 1894 a 5-stamp mill was erected, and later, in 1896, the erection of a new mill on a larger scale was commenced. There is nothing left of this plant to-day. The vein strikes S. 25° E. and has a width varying from a few inches to 5 or 6 feet.

At the time the property was visited work was being confined to a section of the vein above the No. 1 level. The ground here was very tight and the vein filling consisted of broken country rock with ribbons of quartz. The ore is quartz, carrying a little galena and free gold. Very little ore had been encountered, but the ground looked promising and the work was being continued. Further work was contemplated from the lower levels. This was considered advisable as generally the veins in this area have been subjected to faulting movements, causing only slight displacements. Hence the probability of picking up the vein below the No. 3 level appears to be favourable.

Golden Drip. This claim adjoins the *I.X.L.* and *O.K.* on the south and is owned by Mrs. A. J. McKinnon, of Lincoln, Nebraska. Work of an exploratory nature has been carried on since last year under the direction of M. E. Purcell. After doing a considerable amount of trenching a lower tunnel was started and driven in a south-west direction to explore the ground under the old workings situated higher up the hill. This tunnel was in 300 feet; the first 100 feet was through wash, and at a distance of about 200 feet from the portal a small fissure was encountered and followed for about 100 feet. From these workings a small tonnage of ore was extracted and shipped to Trail. A grab sample taken from a few tons sorted for shipment ran as follows: Gold, 0.58 oz.; silver, 1.4 oz. to the ton; copper 1.10 per cent. The ore occurs in small quartz lenses and carries a little galena, iron pyrites and free gold.

The development has revealed the formation of serpentine to have been faulted by numerous slips, and cut by a lamprophyre dyke which closely follows the fissure and cuts it at the eastern end, where the best showing was struck. The old upper workings, which are quite extensive,

did not develop any well-defined quartz-filled fissure, but followed in a north-easterly direction a narrow sheared fracture filled with soft gouge and a little quartz. A small ore-shoot had been mined to the surface at the intersection of a cross-fracture which had an east-and-west direction. This had also been sunk on and the main objective of the low tunnel was to explore the ground in this locality. Although, at the time of examination, there was no ore developed which could be mined profitably on account of its narrow width, the values were encouraging.

REVELSTOKE, TROUT LAKE, AND LARDEAU MINING DIVISIONS.

These Mining Divisions did not contribute to the production this year and no operations on a large scale were carried on, mining activities being chiefly confined to development-work in a small way on a few properties, while some work of a preparatory nature was done on a few other properties with a view to commencing operations next season.

REVELSTOKE MINING DIVISION.

North of Revelstoke, in the "Big Bend," great interest is attached to the bonding by a strong company of the *J. and L.* property on Carnes creek, owned by E. McBean. Under the terms of the bond development-work is to be started in the spring as soon as weather conditions permit. The principal values are in gold and silver associated with arsenical pyrites. At the *Waverley* mine activities have been chiefly confined to road-construction under the supervision of Orville Young. The old road from Albert Canyon is being improved, the Flat Creek route having been abandoned. In the mine the old workings developing the main ore-body have been cleaned out and retimbered, so that it is now possible to make a complete examination of the property. Supplies have been packed in and preparations completed to maintain a small crew at the mine throughout the winter.

It is expected that work will be resumed in the spring at the *Lanark* mine, which has been shut down for several months. W. B. Dornberg was in Revelstoke towards the end of the year making preparations for this purpose.

In the Big Bend district there was the usual amount of prospecting and placer-mining by a few individuals.

Wigwam Group. This property, belonging to J. Kirkpatrick and R. Armstrong, of Arrowhead, comprises a group of six claims situated on the Akolkolex river (locally known as Isaac creek). The trail follows the timbered valley of the creek, which plunges through a deep box canyon in a series of cascades and falls from a height of 400 feet to the valley of the Columbia river. Here is one of the finest power-sites of moderate capacity as yet seen by the writer. The power available varies greatly between the high- and low-water periods, but the minimum power that could be developed during low-water stages is in excess of 3,000 horse-power. The stream is also said to be always free from anchor-ice.

The steep hillside on which the claims are staked consists of quartzites and limestone, the latter appearing in bluffs at about 1,000 feet above the valley-floor. The strata are exposed along their dip and following the foot of the limestone bluffs; iron-stained capping may be seen at intervals over a distance of 1,600 feet.

Very little work had been done; but in a few places, chosen on account of the surface showings, open-cuts and a little tunnelling indicate a zone of considerable width mineralized with sulphides, lead, and zinc, and conforming with the dip and strike of the strata along or near the contact of quartzite and limestone. Whether this mineralization is continuous or occurs in lenses as replacement deposits along the bedding-planes is indefinite.

Generally speaking, the metallic content, consisting of a low-grade mixture of metallic sulphides in a siliceous gangue, is too low in values to constitute ore; while the amount of work done did not disclose any appreciable tonnage that could be mined and treated economically and afforded little knowledge regarding the character and extent of the deposit.

This year the property was taken under option by American interests, who intend doing some exploratory work under the direction of W. T. Dumbleton, of Tacoma. It is proposed to install a small compressor driven by water-power developed from a small creek opposite the claims. The property has the advantage of being conveniently situated to the railway, while plenty of power and timber are available for all requirements.

Wonderful Group and Crystal.

The *Wonderful* group, owned by Joe McKinnon of Revelstoke, consists of the *Wonderful No. 1* and *No. 2* claims near the *Lanark* mine, and situated near Laurie on the main line of the Canadian Pacific Railway east of Revelstoke. The claims have recently been worked under bond by H. L. Taylor, who has also bonded the adjoining *Crystal* claim, which is owned by the Kennedy Estate of Revelstoke. The formation of the area is composed of carbonaceous schists, slates, and bands of limestone which have a north-westerly strike, with steep dips to the north-east. The ore is galena with which small quantities of zinc-blende are associated.

The *Wonderful* vein is a mineralized band of shattered limestone which, conformably with the enclosing schists, strikes up the steep mountain side almost parallel to the *Lanark* vein, from which it is distant about 2,000 feet in a south-westerly direction. Both veins dip at about 70° to the north-east. The width of the *Wonderful* vein is from 12 to 15 feet. The ore, consisting of bunches, stringers, and lenses of galena, favours the hanging-wall contacts with the schists, but is also found in cross-fractures in the limestone.

A brief description of the showings and workings is as follows: The lowest working examined on the *Wonderful No. 1* claim, at an approximate elevation of 6,270 feet, is a short crosscut tunnel giving access to a drift 6 feet in on the vein. In this drift there is exposed an attractive showing of solid cube galena and carbonates 15 inches wide on the hanging-wall side, with from 4 to 5 feet of mixed ore on the foot-wall side. A sample across the 15 inches assayed: Gold, 0.02 oz.; silver, 75.5 oz. to the ton; lead, 69 per cent.; zinc, 6 per cent. Just below this working two car-loads of galena is said to have been extracted from the surface and shipped to Swansea, Wales, in the early days of the camp.

About 75 feet vertically above and a short distance from the lower tunnel an old shaft, now inaccessible, was sunk 15 feet on a 3-inch streak of solid galena. Farther up the mountain and at about 6,475 feet elevation a tunnel has been driven 65 feet on the vein, in which some ore is said to have been taken. No appreciable mineralization was noted.

On the Crystal Crown-granted claim, about midway between the *Wonderful* and *Lanark* veins and at about 6,300 feet elevation, there is an open-cut showing 18 inches of galena disseminated through quartz. Slates and schists form the walls of this vein, which apparently also conforms to the strike and dip of the enclosing rocks.

On the same claim near the western boundary of the *Lanark* property, and at about 6,000 feet elevation a short tunnel has been driven on the supposed extension of the Lanark vein. In this working the only mineralization noted was at the portal of the tunnel, where there is a 6-inch streak of clean galena in a small quartz filled fissure dipping to the south-west at right angles to the dip of the vein on which the tunnel is driven.

All the ground described above was bonded by the Horne-Payne interests when they were working the *Lanark* mine some 28 years ago. The camp has suffered from the lack of a vigorous plan of development. At the mine the old company stoped out all the ore in sight without searching for other ore-shoots, with the consequence that when the main orebody was exhausted work came to a standstill. More recent operators were apparently unable to finance any development of a serious nature, so that after all these years our knowledge of the resources of the camp is in no way increased. The successful operation again of the *Lanark* mine would revive interest in the adjoining ground, including the *Wonderful* and *Crystal* properties.

TROUT LAKE AND LARDEAU MINING DIVISIONS

No production was made from these Divisions this year and mining activity has been slight considering the large number of small properties and prospects in these Divisions which await investigation and development.

A small amount of development was done on a few properties, notably at the *True Fissure*, *Cromwell*, and *Multiplex*.

At the *True Fissure* work was continued on the lower tunnel level under the supervision of Dave Morgan.

At the *Cromwell* Colonel H. H. Armstead recently let a contract for the completion of the crosscut tunnel to an expected intersection with the vein showing on the surface.

In the Poplar camp there was some activity among the prospectors. The *Bullock* mine was shut down during the summer.

The *Foggy Day*, bonded from Mrs. Jowett by Spokane interests, was worked for a time by J. Lamphere for the purchasers, who, according to reports, have dropped the bond owing to their inability to meet the payments.

At the *Multiplex*, near Camborne, work has been carried on by O. T. Bibb with a small crew.

F. R. Blockberger had a number of claims surveyed for Crown grants and is reported to have done some preparatory work on the *Sir Wilfred*, *Steve Namon*, and *Sandy* properties with a view to actively developing them next summer.

Butte Group.* This property, consisting of the *Butte*, *Bonanza King*, *Gallant Boy*, *Harlech*, *Butte Fraction No. 1*, and *Butte Fraction No. 2*, owned by J. G. Jenkins, of Gerrard, is situated in the Bonanza basin at the head of the Middle fork of Haskins creek, just over the divide from American creek, which flows westerly into Trout lake a little above Gerrard, from which place the property is distant about 6 miles by trail. The elevation of the summit crossed by the trail is 7,400 feet and the elevation of the cabin in Bonanza basin is 6,800 feet.

The formation is composed of schists containing bands of limestone and quartzite, the strike of the rocks being north-westerly, with steep dips to the north-east. There are several veins on the claims, some of them fissure-veins and others veins conforming to the stratification of the enclosing rocks. The ore is chiefly galena, with associated zinc-blende and iron pyrites, the latter mineral containing appreciable gold values. Clean zinc ore occurs in places and at other points the mineralization consists of lead, zinc, and iron sulphides disseminated through the gangue, which is quartz and altered country-rock. A streak of grey copper in quartz occurs on the *Butte Fraction No. 2* claim.

The workings, consisting of short tunnels and open-cuts, are scattered over a considerable area and some surveying would be required to show the relations between the different showings. Briefly, it may be said that there are several small showings of ore of shipping grade in the fissure-veins and some showings of undetermined width of ore of milling grade in the bedded deposits.

Further work is required before any definite opinion can be formed as to the character and continuity of the deposits, but the following samples taken by the writer give some idea of the values obtainable:—

	Gold.	Silver.	Lead.	Zinc.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
6-inch pay-streak on foot-wall open-cut on Butte claim (fissure-vein)	0.46	4.0	8.0	10.0
6-inch pay-streak on hanging-wall, same cut	0.32	50.0	64.0	*Nil.*
Sacked carbonates from hanging-wall streak, same cut	1.24	22.5	24.0	0.5
Grab sample from milling-ore in formation lead just east of above open-cut	0.02	18.0	26.0	12.0
6-inch pay-streak quartz and grey copper in open-cut on Butte Frac. No. 2	0.06	116.0	*Nil.*	0.5
Zinc ore from "red fissure" on Butte claim	0.04	0.8	*Nil.*	37.0

ARROW LAKE MINING DIVISION.

Millie Mack. This property is situated on Caribou creek at a distance of about 13 miles from Burton and is owned by H. E. Forster, of Wilmer, who for many years has personally supervised the mining and exploratory work. Many hundred of feet of tunnelling, with numerous open-cuts and extensive ground-sluicing, have failed to locate the vein in-place. The ore which has been extracted from time to time over a number of years consists of broken portions of a quartz vein and occurs in a crushed zone of graphitic slate, which latter lies on a base of igneous rocks, classified as andesite and syenite. This igneous base dips at a slight angle to the east, while the overlying slates, apparently not having been greatly disturbed above the contact, have a fairly uniform northerly and southerly strike and a dip of about 35° to the west. The whole series has been intruded by syenite-porphyry dykes, fragments of which are usually found lying next to vein-matter in the crushed zone.

The smoothly rounded and slickensided surfaces of the segments of vein matter bear evidence of considerable movement under great pressure, while their size and character leave no doubt that they originally came from a strong and richly mineralized vein. The ore varies, but that which probably predominates and carries the highest values consists of quartz impregnated [illegible] galena, tetrahedrite, sphalerite, and arsenopyrite; the gold and silver values increasing in proportion to the amount of arsenopyrite and tetrahedrite present.

This spring it was decided to do some prospecting on the *Black Bear* claim, which adjoins the *Millie Mack* on the north-westerly or opposite side of the mountain. In this vicinity the hillside is covered to a depth of about 5 feet with surface wash and no rock surfaces are visible. However, having found some good-looking float and the location being favourable, a deep open cut was started. After driving a few feet the same crushed graphitic slate was encountered and boulders of ore were extracted. A sample from a 15-ton pile of ore taken from this cut ran as follows: Gold, 1.12 oz.; silver, 233.3 oz. to the ton; lead, 14.5 per cent; zinc, 11 per cent. Since driving this cut a considerable amount of tunnelling has been done and ore was discovered in various places. Another variety of ore found in considerable quantity is arsenical pyrites, a sample of which gave the following returns: Gold, 0.72 oz.; silver, 11.5 oz. to the ton; arsenic, 33.6 per cent.

The tunnels have been driven into the hill along the foot-wall of the crushed zone. The programme of development is to continue this procedure, and by watching the foot-wall carefully the vein may yet be found in-place. Should the assumption prove correct, the vein matter so far discovered belongs to a fissure which cuts both the igneous and slate formations and has been sheared off and broken along their contact.

During the season three men were employed at the property and a new trail was built from the *Black Bear* workings to connect with the trail to the *Millie Mack* camp. It is understood that work will be resumed as soon as weather conditions permit in the spring.

Big Ledge.

An extensive deposit of sulphides known as the "Big Ledge" occurs on Bald mountain, west of Pingston creek, some 6 miles back from the Upper Arrow lake, opposite St. Leon hot springs. The old workings, which vary from about 5,500 to 7,000 feet in elevation, are reached by an old disused road 7 miles in length from the mouth of Pingston creek. From the end of the road a trail 1 mile in length leads to the cabin which was built for some of the claims at the lower end. About twenty-five years ago there were as many as twenty-three claims staked on the "Big Ledge." Later a number of these were abandoned, but a few are still held, including those in which Walter Scott and A. E. Fowler, of Nakusp, are interested.

The mineralization consists of pyrite, pyrrhotite, and sphalerite, with which are associated small amounts of galena and chalcopyrite in places. The iron sulphides evidently predominate, but there is considerable zinc-blende in evidence, graduating from the disseminated variety, which is the most abundant, to "solid" ore, which, judging from assays made for the owners, would assay about 40 per cent. in zinc. No other values are associated with the zinc-blende. The lead and copper contents of the deposit appear to be negligible.

The old workings, chiefly open-cuts and trenches, with some short tunnels, trace the "ledge" for several miles in a westerly direction up the gentle slope of the mountain. At the lower (or easterly) end the workings are in the timber, which extends to about 6,000 feet elevation.

The deposit lies on the hillsides like a blanket and is apparently of the bedded type, erosion having taken place in the plane of the hanging wall of the "ledge," thus exposing the sulphides at intervals for several miles easterly and westerly and for from 50 to 500 feet northerly and southerly.

Judging from the numerous holes penetrating into the foot-wall, which is quartzite or siliceous schist, the width of the sulphides is from 2 to 6 feet. It would appear from old reports, which refer to the great width of the "ledge," that the superficial extent northerly and southerly was mistaken for the true width, giving rise to a belief that the deposit was one of vast size.

The limestone hanging-wall, which was eroded off the sulphides, is well exposed in the bluffs above Empress lake, near the summit. In these bluffs the strata can be seen in their original relations, dipping at from 35° to 40°. A short tunnel driven into the bluffs at the top of a rock-slide exposes a width of 6 feet of mixed iron and zinc sulphides, the iron predominating.

NORTH-EAST KOOTENAY DISTRICT.

GOLDEN MINING DIVISION.

REPORT BY G. E. SANBORN, GOLD COMMISSIONER, GOLDEN.

I have the honour to submit the office statistics of the Golden Mining Division for the year ended December 31st, 1923.

Free miners' certificates (ordinary)	64
Mineral claims recorded	19
Certificates of work issued	14
Bills of sale, agreements, powers of attorney	8

WINDERMERE MINING DIVISION.

REPORT BY E. M. SANDILANDS, MINING RECORDER, WILMER.

I have the honour to submit the office statistics of the Windermere Mining Division for the year ended December 31st, 1923.

Free miners' certificates (ordinary)	91
Certificates of work	72
Certificates of improvements	5
Claims recorded (quartz)	39
Placer leases	1
Bills of sale, agreements, bonds, etc.	17

SOUTH-EAST KOOTENAY DISTRICT.

FORT STEELE MINING DIVISION.

REPORT BY F. A. SMALL, GOLD COMMISSIONER, CRANBROOK.

I have the honour to submit the office statistics of the Fort Steele Mining Division for the year ended December 31st, 1923.

Mineral claims recorded	62
Certificates of work (Form E)	178
Certificates of improvements	62
Bills of sale recorded	23
Mining leases issued	14
Free miners' certificates (ordinary)	231
Free miners' certificates (special)	1
Crown grants issued	62

Revenue.

Free miners' certificates	$ 1,407 00
Mining receipts, general	2,403 25
Taxes on Crown-granted mineral claims	2,707 75
Taxes on mines and minerals	48,683 68
Total	$55,201 68

NORTH-WEST KOOTENAY DISTRICT

REVELSTOKE AND LARDEAU MINING DIVISIONS.

REPORT BY W. MAXWELL, GOLD COMMISSIONER, REVELSTOKE.

I have the honour to submit the office statistics of the Revelstoke and Lardeau Mining Divisions for the year ended December 31st, 1923.

REVELSTOKE MINING DIVISION.
(Charles Aman, Mining Recorder.)

Free miners' certificates	137
Free miners' certificates (company)	2
Locations recorded	82
Certificates of work recorded	63
Assignments recorded	1
Powers of attorney recorded	9
Bills of sale recorded	8
Leases of Crown-granted mineral claims recorded	24
Placer leases	10
Groupings recorded	1
Placer claims recorded	3

LARDEAU MINING DIVISION.
(E. Roberts, Mining Recorder.)

Free miners' certificates	35
Free miners' certificates (company)	1
Locations recorded	58
Certificates of work recorded	70
Bills of sale recorded	4
Powers of attorney recorded	2
Agreements recorded	1
Groupings recorded	7
Cash receipts	$838 50

SLOCAN DISTRICT.

AINSWORTH MINING DIVISION.

REPORT BY RONALD HEWAT, GOLD COMMISSIONER, KASLO.

I have the honour to submit the office statistics of the Ainsworth Mining Division for the year ended December 31st, 1923.

Free miners' certificates	147
Free miners' certificates (company)	2
Mineral claims recorded	76
Certificates of work recorded	235
Bills of sale, agreements, etc.	31
Dredging and placer leases recorded	1
Leases of reverted mineral claims	4

SLOCAN MINING DIVISION.

REPORT BY ANGUS MCINNES, MINING RECORDER, NEW DENVER.

I have the honour to submit the office statistics of the Slocan Mining Division for the year ended December 31st, 1923.

Free miners' certificates	131
Claims recorded	22
Certificates of work	87
Cash receipts	$3,820 15

SLOCAN CITY MINING DIVISION.

REPORT BY THOS. MCNEISH, MINING RECORDER, SLOCAN.

I have the honour to submit the office statistics of the Slocan City Mining Division for the year ended December 31st, 1923.

Free miners' certificates issued	47
Certificates of work recorded	62
Locations recorded	21
Transfers recorded	1
Notices to group	8
Marriage licences	2
Resident special firearms licences issued	3
Resident general firearms licences issued	6
Resident ordinary firearms licences issued	22
Receipts	$620 75

TROUT LAKE MINING DIVISION.

REPORT BY ROY JACOBSON, ACTING MINING RECORDER, TROUT LAKE.

I have the honour to submit the office statistics of the Trout Lake Mining Division for the year ended December 31st, 1923.

Free miners' certificates issued	46
Certificates of work issued	105
Notices to group filed	30
Locations of mineral claims recorded	33
Rerecording of placer claims recorded	2
Transfers of mineral claims recorded	13
Agreements recorded	1
Trade licences issued	9
Game licences issued	6
Prospectors' game licences issued	7

NELSON DISTRICT.

NELSON MINING DIVISION

REPORT BY J. CARTMEL, GOLD COMMISSIONER, NELSON

I have the honour to submit the office statistics of the Nelson Mining Division for the year ended December 31st, 1923.

Free miners' certificates issued	335
Free miners' certificates issued (special)	2
Free miners' certificates issued (company)	2
Mineral claims recorded	143
Certificates of work issued	372
Placer claims recorded	4
Receipts issued for money in lieu of work	2
Grouping notices filed	24
Notices of abandonment	2
Conveyances, etc., recorded	20
Certificates of improvements issued	1
Leases of reverted Crown-granted mineral claims	5

Revenue.

Free miners' certificates	$1,875 50
Mining receipts, general	1,058 30
General receipts, covering lease fees	125 00
Total	$3,058 80

ARROW LAKE MINING DIVISION.

REPORT BY WALTER SCOTT, MINING RECORDER, NAKUSP

I have the honour to submit the office statistics of the Arrow Lake Mining Division for the year ended December 31st, 1923.

Free miners' certificates issued	40
Certificates of work recorded	8
Mineral claims recorded	8

ROSSLAND DISTRICT

TRAIL CREEK MINING DIVISION.

REPORT BY W. H. REID, GOLD COMMISSIONER, ROSSLAND

I have the honour to submit the office statistics of the Trail Creek Mining Division for the year ended December 31st, 1923.

Free miners' certificates (individual)	83
Free miners' certificates (company)	2
Free miners' certificates (special)	4
Locations recorded	35
Certificates of work	40
Bills of sale	9
Notices to group	4
Leases granted under section 18(a), "Taxation Act"	6
Total revenue received	$1,220 88

WESTERN MINERAL SURVEY DISTRICT (No. 6).

REPORT FOR YEAR 1923.

By Wm. M. Brewer, Resident Mining Engineer.

The Western Mineral Survey District (No. 6) includes the following seven Divisions: Alberni, Clayoquot, Quatsino, Nanaimo, and Victoria (embracing the whole of Vancouver island), and Vancouver, New Westminster, and a portion of Nanaimo, on the Mainland.

The area within the boundaries of the district is approximately 248 miles from north to south by 213 miles from east to west, including the area covered by water between the Mainland and Vancouver island.

Before commencing my annual report for the year 1923 I desire to extend to the several members of the Geological Survey of Canada, mine managers, prospectors, and to all others engaged in the mining industry with whom I have had business during the past year my sincere thanks and appreciation for the many courtesies that have been extended to me.

During the past year I have examined mineral claims in the following sections:—

Nanaimo Mining Division: Near the headwaters of the Klinaklini and Homathko rivers; Texada, Quadra, and Lasqueti islands; Phillips and Frederick arms on the Mainland; and near Quatse lake, north-westerly part of Vancouver island.

Vancouver Mining Division: Howe Sound and Jervis Inlet.

New Westminster Mining Division: Near the head of Chilliwack lake and near the outlet of Pitt lake.

Victoria Mining Division: Jordan, Leech, and Sooke River sections, also Mount Brenton and Chemainus River sections.

Alberni Mining Division: Taylor River and Alberni Canal sections.

Clayoquot Mining Division: Kennedy Lake and River sections: Sidney Inlet and Nootka Sound sections.

Quatsino Mining Division: Elk Lake and Holberg sections.

The development of metalliferous mining during 1923, while not marked by any spectacular features, has shown steady improvement. The number of prospectors, while comparatively small, has shown an increase over the previous two or three years.

Although from an economic standpoint the most important mineral in the Nanaimo Mining Division is coal, no reference is made to this, the subject being fully dealt with by the several Mine Inspectors.

The most interesting feature of the mining industry in the district is the completion and the steady operation of the new concentrator erected by the Britannia Mining and Smelting Company, which was started up early in March.

On Vancouver island the Tidewater Copper Company, working the *Indian Chief* group of mineral claims on Sidney inlet, operated practically continuously during the past year, although in the early part of the year lack of water to run the power plant caused reduced output. This handicap was overcome by the installation of a 300-horse-power semi-Diesel engine of the Fairbanks-Morse Y type.

In the Quatsino Mining Division development-work was resumed on the *Old Sport* mine, which has been shut down since 1920. This property is operated by the Coast Copper Company, a subsidiary to the Consolidated Mining, Smelting, and Power Company of Canada.

Owing to the low price of copper during the past two years there has been little encouragement for operators to attempt the development of new copper-mines; consequently most of the inquiries have been for gold- and silver-producing properties. To sum up, the progress in the metal-mining industry in the district during 1923 may be briefly described as conservative and encouraging.

The bibliography pertaining to the Western District (No. 6) has been increased during 1923 by the publication of the following reports:—

Alberni Area, Vancouver Island, B.C., by J. D. McKenzie. Geological Survey, Canada, Summary Report, 1922, Part A.

Lucky Four Mining Property, Cheam Range, B.C., by C. L. Cummings. Geological Survey, Canada, Summary Report, 1922, Part A.

Annual Report of the Minister of Mines, B.C., for 1922.

Coal Resources of Southern Vancouver Island, by J. D. McKenzie. Geological Survey, Canada.

When considered from the standpoint of production, the metalliferous mining [illegible] a very substantial increase as compared with the production during the [illegible] years.

Prospecting.—Several prospectors have been carrying on systematic prospecting [illegible] during 1923 in portions of the district which have been practically neglected during recent years. In some cases this work has been done on old Crown-granted mineral claims which had reverted to the Government for non-payment of taxes and for which leases were obtained from the Government under the provisions of the "Taxation Act Amendment Act, 1920."

The sections of the district in which the most active new prospecting has been carried on during 1923 have practically all been examined by myself during the past season and the description of them will be found in the following report.

Labour Conditions.—During the past year the relationship between capital and labour in the mining industry has been harmonious. In the early spring the difficulty of finding experienced miners presented quite a serious proposition, but at the time of this writing the mining companies are experiencing no difficulty in securing all the miners they need.

Non-metallic Minerals.—The Western District is well supplied with non-metallic minerals, for which markets have been found. These mineral deposits will be found fully described later in this report, so it is only necessary to make brief reference.

The mining and shipping of talc from near Lasqueti river has progressed during 1923, but as the demand for powdered talc is limited, production has been confined to that of the Eagle Talc and Mining Company, of Victoria, and although other deposits of talc are known to exist in the same district, yet the commercial demand has not been sufficiently great to warrant the opening-up of new properties.

On Demamiel creek, near Sooke harbour, there is a deposit of clay, the analysis of which shows it to be a low-grade bauxite, for which during the past year a market has been found for refining gas. This bauxite occurs in association with deposits of low-grade limonite iron ore.

Building-stone.—The Western District contains several deposits of excellent building stone. Three varieties—granite, sandstone, and andesite—are found in several localities. Granite quarries of considerable extent are being worked on Nelson island and Granite island; a sandstone-quarry on Newcastle island, near Nanaimo, and an andesite-quarry on Hardington island, 4 miles west of Alert Bay.

Limestone for use in the pulp mills as well as for hydrated lime is quarried on quite a large scale at the north end of Texada island, and for the manufacture of Portland cement on Saanich arm.

Crushed Rock and Gravel.—The most extensive quarries from which crushed rock and gravel are obtained are those situated on the east side of Howe sound and on Vancouver island near Victoria.

Iron and Steel Manufacture.—In Vancouver during the past year a new electric furnace has been installed by K. W. B. Worsoe for the Wallace Foundry, who has been making a high grade of steel castings from iron and steel scrap. These castings are for use in the construction of the floating dry-dock being built at the Wallace Shipyards, North Vancouver.

ALBERNI MINING DIVISION

During 1923 metalliferous mining in the Alberni Mining Division has not been at all active; in fact, of the fifty Crown-granted mineral claims and about forty not Crown-granted but in good standing, so far as the annual assessment work is concerned there was only one [illegible] where development-work was appreciably extended, and that was the *Morning* group on Taylor river.

The Alberni Mining Division is quite mountainous. From the south-east to the north-west a wide belt of Vancouver island is occupied by the Beaufort range of mountains, which is cut by several fiords and valleys. The largest of the fiords is the Alberni canal, and Barkley sound is navigable to its head, at Port Alberni, for steamers drawing upwards of 20 feet.

Great Central lake drains into Stamp river. Sproat lake into Sproat river, forming a junction with Stamp river. These two form Somass river, which empties into the head of the

Alberni canal. Nahmint lake empties into Nahmint river, flowing into the westerly side of the Alberni canal about 16 miles from its head. Henderson lake empties into Henderson river, a tributary of Uchucklesit harbour at the southerly end of the Alberni canal.

My object in calling attention to these lakes and rivers is because they afford such excellent opportunities for prospectors to explore the westerly part of the Alberni Mining Division.

Although this section of the west coast of Vancouver island has been prospected for thirty years, very little real prospecting has been done in the mountains which border these lakes and rivers. The south-westerly boundary of the Esquimalt & Nanaimo Railway land grant crosses Alberni canal and Sproat and Great Central lakes, and this fact has apparently discouraged exploration in that portion of the Alberni Mining Division.

Morning Group.

This group consists of the *Morning*, *Morning No. 1*, and *Apex* mineral claims, situated near the north bank of the Taylor river, about 3½ miles above the mouth. The owners are A. L. Smith and associates, of Alberni. The property is reached by automobile from Alberni to Sproat lake, by launch up Sproat lake to the head of Taylor arm, and from there on foot by a good pack-trail.

The *Morning* group occupies practically the same ground as that formerly known as the *Columbia* group, which I reported on in the Annual Report for 1916, pages 318, 319. Since that time the record of the original group of mineral claims was allowed to lapse, and in 1922 the ground was restaked, the old workings cleared out, the trail reconstructed, and further development-work planned.

In an examination made by myself in 1923 I found that a very important part of the development-work had not been seen in 1916. This was an adit driven 343 feet on the strike of a vein, in which the continuity of the vein for that distance is proved. The prospect shows such promising possibilities that I deem it advisable to quote from the former 1916 Annual Report, which might not be available.

Geology.—No geological survey has yet been made in the vicinity of the *Morning* group, where the rock formation belongs to the Vancouver group of volcanics as classified by Dawson, Clapp, Dolmage, and McKenzie, of the Geological Survey of Canada. The contact between these volcanic rocks and a comparatively wide belt, belonging to the Nanaimo series, composed of shale and sandstone, occurs about 3 miles easterly from the *Morning* group.

The volcanic rocks are very extensively sheared and several well-defined fissures are noticeable within the shear-zones. The vein-filler in these fissures is generally quartz, but brecciated country-rock is often found associated with the quartz. The vein-filler is heavily mineralized generally with iron pyrite, arsenopyrite, and pyrrhotite, with occasionally crystals of zinc-blende and galena. Some faults in the volcanic formation are observable in the underground workings. The wall-rock enclosing the quartz veins is a typical diorite.

Ore-deposits.—There is apparently a well-defined vein system on the *Morning* group, but whether there are three separate veins nearly paralleling each other, or whether the veins are lenticular in structure with the lenses *en echelon*, will require more work than has been yet done to determine. Each of the veins dip almost vertical, the walls are well defined, and there occurs several inches of gouge between the mineralized gangue and the walls.

The development-work was done on outcroppings at an elevation of about 400 feet above Taylor river, and also on a very promising outcropping about 1,500 feet higher.

The shear-zone can be followed from the *Morning* across the *Morning No. 1* on to the *Apex*, but whether the vein system maintains its continuity throughout that distance has not been yet determined. In an adit on the *Morning* a quartz vein maintains continuity to the face of an adit 343 feet from the portal. This vein, varying from 12 inches to 5 feet in width, occurs between well-defined walls and gives indications of being deep-seated, but, so far as I could see, does not outcrop below the level of the adit and the river.

Samples and Assays.—Seven samples were taken at haphazard from the adit, as follows:—

Sample No. 1, across 16 inches from the face of the adit at the fault, assayed: Gold, 0.72 oz.; silver, 0.5 oz.; copper, *nil.*

Sample No. 2, across 12 inches taken from the east side of a short crosscut near the fault and face of the adit, assayed: Gold, *nil;* silver, *nil;* copper, *nil.* Between samples Nos. 1 and 2 a horse of barren rock occurs 2 feet wide, and No. 2 sample was taken to determine whether it was a part of the vein.

Sample No. 3, across 4 feet 4 inches wide at a point 55 feet from the face of the adit assayed: Gold, 0.36 oz.; silver, 0.2 oz. to the ton; copper, *nil*.

Sample No. 4, across 4 feet at a point about 80 feet from the face of the adit assayed: Gold, 0.14 oz.; silver, 0.2 oz. to the ton.

Sample No. 5, across 4 feet from a point about 88 feet from the face of the adit assayed: Gold, 0.12 oz.; silver, 0.1 oz. to the ton; copper, trace.

Sample No. 6, across 4 feet from about 246 feet from the face of the adit assayed: Gold, trace; silver, trace to the ton; copper, *nil*.

Sample No. 7, across 4 feet from near the portal of the adit, assayed: Gold, *nil*; silver, *nil* to the ton; copper, 0.8 per cent.

Since the report on my examination in 1916 (which see) no further work has been done at any of the points described in that report.

The *Morning* group is situated outside of the Esquimalt & Nanaimo Railway (and grant), consequently there can be no contention with regard to the ownership of all the minerals contained in the ore.

Transportation.—The transportation question should not be hard to solve, especially if the ore is concentrated near the mineral claims, as it very readily can be. A gravity surface tramway about 3½ miles long could be easily built from a point near the Taylor river below the claims, and concentrates hauled out to Sproat lake and from there transported in scows to the foot of the lake to a point on the Sproat Lake branch of the Esquimalt & Nanaimo Railway, which I am informed will be in operation in the near future.

Suggestions to Prospectors.—There are several reasons why the section near the head of the Alberni canal has attractive features to prospectors. The first is that it is conveniently situated and within easy reach of Alberni, where the Government Agent and Mining Recorder are located and supplies, mining-tools, etc., can be obtained.

Secondly, there is a belt of country which parallels the south-westerly slope of the Beaufort range extending from Mount Arrowsmith beyond the head of Great Central lake, in which small veins of gold-bearing quartz have been discovered from time to time. Although these generally are comparatively narrow, yet the gold values contained in most of the veins are sufficiently high to warrant prospecting operations.

While this section has been prospected to some extent, yet it cannot be considered to have been thoroughly gone over.

CLAYOQUOT MINING DIVISION

The Clayoquot Mining Division adjoins the Alberni Mining Division on the west and includes all that portion of the west coast of Vancouver island from Ucluelet bay north-westerly to Esperanza inlet. This Division has been fairly well and thoroughly prospected along the shores of the several inlets and for a short distance up the rivers which flow into those inlets, but the north-easterly part of the Division along the south-westerly slope of the Beaufort range has never yet been prospected to any extent, the principal reason being that the mountains are very precipitous, with peaks reaching to high altitudes.

About the only section of the Division in the north-easterly part that has been explored to any great extent is that at the headwaters of Bedwell river, which empties into Bedwell sound. This section attracted attention as far back as 1898, when Joe Drinkwater and David Nichols crossed the range into the Alberni Division at head of Drinkwater river, and from there prospected to the head of Great Central lake, canoed down the lake, and reached Alberni.

It was on this trip that these prospectors located the *Big Interior* group of mineral claims on the north-easterly slope of the most rugged part of the Beaufort range. Some years later the property known as the *Ptarmigan* group was located on the westerly slope of the same mountain.

Several peaks in this mountain range in the vicinity of the *Big Interior* and *Ptarmigan* mines reach altitudes exceeding 6,000 feet and about 2,000 feet above the timber line. Near the base of the range some gold-bearing quartz veins have been discovered on the Yes group of mineral claims, which have been developed to some extent by J. R. Woodworth and associates, who erected a small mill on the property and worked during 1921 and 1922. Great difficulty was experienced owing chiefly to poor transportation facilities. The camp buildings were burnt in the fall of 1922 and the very great depth of snow broke down some of the bridges during the

winter of 1922–23, while the high water in Bedwell river flooded the main trail, which is about 13 miles long, and carried away portions of the plank road constructed for about 1½ miles from the mouth of the river. The damage was so extensive and expensive to repair that operations were not resumed during 1923. There are no other properties being worked near the river, although several mineral claims located some years back are still in good standing.

Mining operations in this Division during 1923 have been confined to those conducted by the Tidewater Copper Company, Limited, on Sidney inlet, and to prospecting-work. The most important prospecting-work has been done by Lachland Grant, Anthony Watson, William Spittal, J. B. Woodworth, and others near the head of Kennedy lake and on Kennedy river, also by William Poole, A. Park, and others near the head of Tahsis canal.

The production from the Clayoquot Mining Division during 1923 has been very satisfactory when it is considered that it all came from the property of the Tidewater Copper Company.

Considerable disappointment has been felt recently owing to the fact that active mining operations were not resumed on the *Black Prince* group on Sidney inlet, adjoining the *Indian Chief* group of the Tidewater Copper Company, and also that nothing was done towards resuming work on the *Ptarmigan* group, owned by the Ptarmigan Mines, Limited, London, England. But as access to the last-named property is gained by way of the same wagon-road and trail up the Bedwell river for a distance of 13 miles as are used to reach the *You* group, which was destroyed as above mentioned, the delays in resuming operations are excusable, if for no other reason than the lack of transportation facilities. The cost for repairing the road and trail, which would amount to several thousand dollars, would naturally deter any one from considering work on the claims.

Kennedy Lake section comprises an area extending from the outlet of Kennedy lake into Kennedy river easterly to the head of the eastern arm of the lake and up the upper Kennedy river for a distance of about 6 miles, which is about the limit to which prospecting-work has been done adjoining that river. The prospectors are urging that a trail be constructed farther up the river to what is known as the "Big Bend," and from there cross to the Taylor river to connect with the trail at the head of Taylor arm and Sproat lake, by which a virgin section of country of about 5 miles in width would be opened to prospectors. No action has yet been taken in this matter nor have any prospectors been engaged in exploring that vicinity.

The Kennedy Lake section, especially that portion in the vicinity of the head of the lake and its junction with Kennedy river, has been chiefly noticeable in the past because of several discoveries of gold-bearing quartz veins, most of which were made twenty-five years ago when a concentrating-mill was erected on the *Rose Marie* group, situated about 3 miles up Kennedy river.

The old work on the *Rose Marie* group was done under the management of the late Barclay Bonthrone, who represented English capital. Operations were closed down at the time of the South African War and the group of claims was kept in good standing by Mr. Bonthrone for some years; in fact, until the destruction of the mill occurred during the extremely heavy snowfall in the winter of 1915–16, when most of the machinery was so seriously damaged that it was reduced to scrap.

Later the *Rose Marie* group was acquired by Anthony Watson, of Alberni, and Clarence Dawley, of Clayoquot. The claims were restaked and renamed the *Rose Group*, which comprises the *Rose*, *Maggie*, *Marie*, and *Sadie* mineral claims. The property was examined and reported on by D. G. Forbes, M.E., in the Annual Report for 1913, and by myself in the Annual Report for 1916, at which latter date the face of the adit, which had been extended since Mr. Forbes's examination, was sampled, and assayed: Gold, 0.6 oz.; silver, 0.2 oz. to the ton; copper, trace. The sample was an average across 16 inches. From 1916 to July, 1923, when I again examined the property no further work had been done in extending the main adit. It was recently reported that the property was being acquired by J. B. Woodworth, of Thorley Park, Vancouver, and associates, who intend to continue the development-work in the near future.

The topography of the mountain in which the *Rose* quartz vein occurs is rather unusual, as where the mountain has been cut through by the Kennedy river the face is quite precipitous and the quartz vein has been exposed by nature for a vertical height of approximately 1,500 feet. In referring to this section of the Clayoquot Mining Division, Victor Dolmage, in the Summary Report, 1920, Part A, Geological Survey of Canada, in his report entitled "West Coast of Vancouver Island between Barkley and Quatsino Sounds," calls attention to the fact that these

gold-bearing quartz veins constitute a type of mineral deposit which is different from any previously described in connection with the west coast, and, although they have not yet proven to be of commercial importance, they do in places show good gold values and may be further prospecting turn out to be valuable.

So far as the last paragraph is concerned, it should be noted that the gold-bearing quartz veins referred to by myself as occurring on the Taylor river, China creek, and Granite creek in the Alberni Mining Division, and also the quartz veins on the *Della* and *Yok* groups in the vicinity of the *Big Interior* and *Ptarmigan* groups of mineral claims, are not included in any of the Geological Survey Reports, but that all of these quartz veins are apparently similar occurrences to those referred to by Dr. Dolmage.

Kennedy Lake Section.

Wanderer Group. This group contains the *Wanderer* and *L. Grant* mineral claims, situated near the head of Kennedy lake. The group is owned by Lachland A. Grant and associates, of Tofino. In 1923 I made an examination of the extension of the development-work that had been done since my examination in 1921. As the group was reported on in the Annual Reports for 1918, page 262, and 1921, page 213, it is only necessary here to refer to the results of the extension of the work.

The ore occurs in this property in a gold-bearing quartz vein which shows great persistence for several hundred feet along its strike, S. 40° W. (mag.). Unfortunately the recent work, a continuation of the lower adit, instead of showing any increased width in the vein, which had averaged about 5 inches in width in the previous workings, only showed a width of 2 inches in the present face of the adit.

The values obtained from samples from the old workings had varied from: Gold, 0.10 oz.; silver, 0.4 oz. to the ton, to: Gold, 1.86 oz.; silver, 0.8 oz. to the ton; copper, 15 per cent. No samples were taken from the more recent work as the vein had pinched down from 5 inches to 2 inches.

Discouraging as this work seems to be, I am still inclined to think that there is a possibility that further prospecting is warranted owing to the persistence of the vein along the strike and the values carried by the quartz, coupled with the fact that work has demonstrated that the vein not only maintains continuity along its strike, but also vertically, since the quartz vein can be traced down the precipitous mountain-side for about 200 feet below the outcropping, from which several specimens have been taken, in which the gold was visible to the naked eye.

Grant Group. This group contains the *James Grant* and *Lachland Grant* mineral claims, owned by Lachland Grant, of Tofino, and Anthony Watson, of Port Alberni. The group is located on Kennedy river, about 3 miles above where it flows into Kennedy lake.

Transportation.—The group is at present reached by launch from Tofino village to the Clayoquot Cannery on Tofino arm; thence by canoe up the rapids on lower Kennedy river to the outlet of Kennedy lake, and from thence by launch to the mouth of upper Kennedy river and from there by trail about 5 miles long to the southerly bank of an unnamed creek, a tributary of the Kennedy river. From the last point to the outcrop of the main vein there is a stiff climb of about 500 feet up the mountain-side near the creek, as the creek bed cannot be travelled owing to its being in a very deep canyon.

Geology.—The rock formations on the *Grant* group belong to the Vancouver group of volcanics, in a shear-zone in which occurs a system of very persistent quartz veins. The most persistent of these is exposed in the bed of the creek referred to, and strikes nearly east, while another strikes N. 20° E. and should form a junction with the vein in the creek bed, but the banks are so precipitous, forming a canyon about 200 feet deep, that it has not been possible to determine the point of junction or to prospect in the creek bed near where the junction should occur.

There is apparently quite a wide shear-zone in the country rock, the shearing movement having been so violent that near the quartz veins the structure of the country rock approaches a schist. The walls of the veins, which dip almost vertical, are slickensided, and usually there is gouge material between the vein filler and the walls.

Ore-deposits.—Gold-bearing quartz float was found on this mountain-side and in the bed of the unnamed creek, about twenty years ago, by Lachland Grant and W. N. Kenyon on a claim staked by Kenyon, which is now called the *James Grant* of the *Grant* group and is owned by

Anthony Watson. Kenyon constructed an arrastra, the ruins of which can be seen to-day, about 300 feet vertically above the main Kennedy River trail and about 1,500 feet easterly from the main trail, and started work on a quartz vein 4 feet wide, with strike of N. 20° E. (mag.) and dip vertical. After operating the arrastra for some months on the *James Grant* it was found that the proportion of the ore which was free-milling was too small to give satisfactory returns from treatment in the arrastra.

The workings from which the ore was taken and milled in the arrastra were a deep open-cut and shallow shaft on the vein known as the cross-lead. A sample taken from an open-cut where this quartz vein is 4 feet wide, and from the face of the cut about 8 feet deep, assayed: Gold, 1.30 oz.; silver, 0.70 oz. to the ton; copper, 1.6 per cent.

There is a considerable flow of water in the creek, the bed of which is a series of precipitous falls and sampling the vein is quite a difficult proposition, so much so that I was only able to obtain two samples, one of which, across 18 inches, assayed: Gold, 0.34 oz.; silver, 1.2 oz. to the ton; copper, trace. The second sample, taken from the same fissure 2 feet wide and about 150 feet farther up the creek and nearly 100 feet higher elevation, assayed: Gold, 0.30 oz.; silver, 0.2 oz. to the ton; copper, trace.

Blue Bird Group.

This group contains the *Blue Bird* and *Blue Jay*, the former being owned by Miss Winifred Dixon and the latter by William Spittal, both of Tofino. The group is located about 5 miles up Kennedy river from the mouth and on the west side.

Ore-deposits.—The ore-deposits on the *Blue Bird* group occur as lenticular veins in a wide shear-zone which in places is upwards of 40 feet wide. The main vein in the shear-zone where exposed on the *Blue Bird* can be traced on to the adjoining *Blue Jay*, occurring between schistose walls dipping vertically, conformable with the shearing-planes in the zone.

The vein is principally quartz and the mineralization consists of chalcopyrite and iron pyrite, with some arsenopyrite. A sample taken from an open-cut in a steep bank of an unnamed creek assayed: Gold, 0.06 oz.; silver, 1 oz. to the ton; copper, 0.7 per cent. Another sample, taken from apparently the same schistose shear-zone and possibly from the same quartz vein as the first-mentioned sample was taken, but from a point about 1,200 feet farther up the creek, assayed: Gold, 0.30 oz.; silver, 0.1 oz. to the ton; copper, trace.

William Spittal, who has done all the work on the claims, has also built a cabin on a bench near the river.

While samples can be taken from the quartz veins in the vicinity of the Kennedy river carrying fair values, it is a serious question whether under the present conditions ore that carries values averaging less than $10 a ton "run of mine" can be mined and treated successfully.

North-westerly from the Kennedy River section there is practically nothing known by white men of the interior of the island for a distance of approximately 100 miles, or to the vicinity of the streams and lakes that flow into Quatsino sound; the average width of this unexplored area is approximately 20 miles. This region may be described as very mountainous, some of the peaks as viewed from either coast having elevations 6,000 feet and over.

Quite a large area of this unexplored section is included within the boundaries of the Clayoquot Mining Division, and the western fringe has been prospected to some extent at and near the headwaters of the Clayoquot river, which empties into the Clayoquot arm of Kennedy lake; Tofino creek, which empties into the head of Tofino inlet; Tranquil creek, which empties into Tranquil arm of Tofino inlet; Bedwell river, which empties into Bedwell sound; Sidney Inlet; Hesquoit lake; Gold river, which empties into Muchalat arm of Nootka sound; Tahsis river, which empties into the head of Tahsis canal; Zeballos river, which empties into the head of Zeballos arm, Nootka sound; Tahsish river, which empties into Tahsish arm of Kyuquot sound; and Kokshittle river, which empties into the head of Kokshittle arm of Kyuquot sound. The prospecting in these sections has not been very thorough, except at Sidney inlet, where the Tidewater Copper Company, Limited, has been operating the *Indian Chief* mine, and the head of Tahsis canal, where William Poole has been prospecting and developing the *Star of the West* group of mineral claims.

There has been no detailed geological survey of the area just referred to, but the west coast line north-westerly from the Alberni canal was examined during 1917, 1918, 1919, and 1920 by Victor Dolmage, of the Geological Survey, but his examinations only included the vicinity of

Quatsino sound. His reports are found in the Summary Reports [illegible] mentioned, and are very thorough so far as the country adjacent [illegible]

The easterly coast-line of Vancouver island has not been [illegible] of the Geological Survey north-westerly from Comox harbour [illegible] late Dr. Dawson in 1885, and so far as I can learn the [illegible] north-westerly from Comox harbour to the vicinity of Port Hardy [illegible] of Vancouver island, is practically an unexplored country.

Nootka Sound Section.

Star of the West Group.

This group contains the *Hakadato*, *Wolverine* and *Star of the West* [illegible] claims, situated on the westerly side at the head of Tahsis canal. The property is owned by William [illegible] and T. T. Gardhouse of Nootka. The *Star of the West* claim is about 1,600 feet from the shore of the canal. [illegible] the shore and the claim was staked as the *Tahsis* in the name of J. [illegible] of Vancouver on April, 1923, but no prospecting-work had been done on it when I examined the [illegible]

The head of Tahsis canal is about 4 miles northerly from Tahsis [illegible] the canal with Esperanza inlet and the open Pacific ocean and forms the northern boundary of Nootka island.

Geology.—The geologic formations in the vicinity of Nootka sound are described generally by Victor Dolmage in Summary Report, 1920, Part A, "West Coast of Vancouver Island between Barkley and Quatsino Sounds," Geological Survey of Canada.

In his report Dolmage does not describe the geology along Tahsis canal in detail except in referring to the marble-quarries in Deserted creek. He considers the Vancouver group, as being the oldest geologic formation and generally the most widely distributed. It is [illegible] along the Tahsis canal that on the easterly side there extends a lofty range of mountains made up almost entirely of crystalline limestone with numerous igneous dykes as intrusions that are so prominent that they can be seen from boats on the canal. It appears as though the canal marked the line of contact between this limestone and the Vancouver volcanics which predominate on Nootka island along the westerly side of the canal.

The limestone-belt crosses the canal and extends in a westerly direction from near the head with the contact between it and the volcanic rocks of the Vancouver group on both its northerly side as well as on the southerly side occurring on the *Star of the West* group.

Ore-deposits.—The occurrences of ore on the *Star of the West* group belong to the contact metamorphic type of ore-bodies, but do not occur exactly at the contact of limestone and igneous rocks. The ore-outcroppings were first found on the *Star of the West* about 125 feet westerly from the No. 1 post, where the occurrence is about 6 feet wide and is exposed along the westerly strike for some considerable distance, as is demonstrated by the series of open cuts. In addition to a 12-foot prospecting-hole, in which the ore occurs apparently as a replacement of limestone which is very much altered and broken up. The dip of the ore-body is 85° towards the north and the outcropping occurs at an elevation of about 450 feet above sea level. A general sample taken from the prospect-hole assayed: Gold, 0.24 oz.; silver, 1 oz. to the ton; copper, 9 per cent; zinc, 14 per cent.

The mineralization of the ore deposit is chalcopyrite associated with some pyrite, pyrrhotite, a little galena, and zinc blende. The gangue in which this ore occurs is quartz and [illegible]

Up to the time of my visit no outcroppings of ore had been discovered on the *Wolverine* mineral claim, which adjoins the *Star of the West* on the westerly side, but after crossing the *Wolverine* and passing the No. 1 post on the adjoining *Hakadato* claim, 600 feet westerly from the No. 1 post and near the location line, the outcroppings of an ore-deposit have been exposed at an elevation of about 1,500 feet above sea level. The continuity of this ore-body has been traced by open cutting for about 135 feet, chiefly in a bluff made up for the [illegible] with intrusive igneous dykes, one very prominent dyke being about 18 inches wide [illegible] of a long crosscut. This dyke divides the ore-body as exposed into two parts [illegible] about 30 inches wide, practically at right angles to the strike of the ore-body. A general sample from the face of the open cut, but not an average of the entire ore-body, assayed: Gold, [illegible]; silver, 1.5 oz. to the ton; copper, 16 per cent.

The mineralization of this ore-body is chalcopyrite, associated with some pyrite, pyrrhotite, occasional crystals of galena, but no zinc blende visible to the eye. In this characteristic the ore on the *Hakadato* mineral claim appears to vary from that on the *Star of the West*.

Another exposure of the same character of ore as that just mentioned occurs in a southerly direction and about 175 feet distant from the open-cut from which the first sample was taken. The ore here is exposed by an open-cut, the sample from which assayed: Gold, trace; silver, trace to the ton; copper, 2.5 per cent. Near this point a deep gulch, and apparently a fault, cuts the formation, and on the opposite side of this gulch on a steep cliff the outcroppings of a body of chalcopyrite in a garnetite gangue about 6 feet wide was exposed by trenching and stripping, a sample from which, generally representative of the ore exposed, assayed: Gold, 0.04 oz.; silver, 0.8 oz. to the ton; copper, 7.5 per cent.

The manner in which the ore-outcroppings occur indicates either the probability of there being two distinct ore-bodies lying nearly parallel, or the possibility that crosscutting may show a mineralized zone 175 feet wide, with lenses of ore as concentrations in the zone, but considerably more work should be done before the problem can be definitely solved.

Southerly from the last-mentioned outcroppings there occurs a contact between the limestone and granodiorite, while northerly from the point where the first sample was taken there occurs a contact between the limestone and Vancouver volcanics.

Westerly from and adjoining the *Hakadato* mineral claim the *Yokamma* mineral claim has been staked by A. Park, of Nootka, who had this staking and recording done only a short time previous to my visit. There had been no prospecting-work done, though the indications point to an extension of the mineralized zone on the *Hakadato* claim occurring on the *Yokamma*.

Mr. Poole has also constructed a trail from the west shore to the prospecting-work on the *Hakadato* claim, and has erected two cabins, one at the beach and the other near the workings on the *Hakadato*, where he has also erected a blacksmith-shop.

All of this work has been done within the past two years and the systematic method followed by Mr. Poole is quite praiseworthy. The prospect as a whole appeals to me, so far as can be judged from the work already done, as being very promising.

Another section of the Division which received some attention from prospectors during the past year is that around Muchalat arm, which penetrates Vancouver island about 20 miles from Zuciarte channel, the entrance being opposite Bligh island.

Gold river flows from a range of mountains, in which are the highest peaks on Vancouver island, southerly into Muchalat arm, about 2 miles from its head. Gold river has several important branches and drains a very large mountainous area; about 4 miles northerly the main river forks, the East fork rising in Donner lake and the main river in Gold lake, while the West fork flows from Muchalat lake. Victoria peak and Crown mountain, the two loftiest peaks on Vancouver island, are near the headwaters of the main river.

Legends having been handed down of ancient gold-mines having been worked on Gold river, this section has received intermittent attention from prospectors for the past twenty-five years. Float-ore has been found near Muchalat arm which assayed as high as: Gold, 0.40 oz.; silver, 2.4 oz. to the ton; copper, 5 per cent.; while another sample only assayed: Gold, *nil;* silver, *nil* to the ton; copper, 0.7 per cent. Unfortunately no deposit of ore of commercial extent has yet been discovered. Local prospectors, however, continue to search, and it is possible that some discoveries of interest may be reported.

Tlupana arm penetrates the island for about 5 miles northerly from its entrance, which is nearly midway between the entrances to Muchalat arm and Tahsis canal.

The only minerals discovered in commercial quantities in this section are magnetite at Head bay and marble on Deserted creek, Tlupana arm. The magnetite deposits are quite extensive and the ore is high grade and pure. The deposits are 1 or 2 miles by easy grade from an excellent deep-water harbour.

Everything considered, the Nootka Sound section presents features which are most attractive for prospectors.

Sidney Inlet Section.

The Sidney Inlet section has been the most important part of Clayoquot Division, as the Tidewater Copper Company has carried on almost continuously since 1916, when the present company was organized after the *Indian Chief* group had been acquired from the Dewdney Canadian Syndicate. As the Tidewater Copper Company has met with financial difficulties, I draw special attention to its operations and the development-work done during 1923.

Area and Location.—The *Indian Chief* group contains the *Tinnecanum*, *Scottet Fraction*, *Brutus No. 2*, *Mephistopheles Fraction*, *Leschi*, *Victor*, *Victor Fraction*, and *Dewdrop Fraction*

TIDEWATER COPPER CO

Crown-granted mineral claims on the West arm of Sidney inlet. The group extends from the beach up the southerly slope of a steep mountain to an elevation of 1,900 feet and across that summit to a narrow valley on the northerly slope. The property is reached by the "Princess Maquinna," which makes three trips each month, Sidney inlet being one of its regular ports of call.

History.—Since the property was acquired by the Tidewater Copper Company in 1916 it has been equipped with a concentrator in which the oil-flotation method has been successfully employed. Underground development has been extended until there are several thousand feet of workings more than in 1916. When the concentrator was erected in 1917 it was supposed to have a capacity to treat 150 tons of ore daily, but after operating for a few months it was found that about 50 tons was the limit of capacity. As the power was furnished from coal costing about $100 a day and the ore was low grade, it was impossible to operate profitably. Operations were suspended early in 1918; after a few months' idleness new capital was acquired by the company through Minor Keith, of New York, and under the management of H. B. Price operations were resumed in the underground workings. The footage in working-openings and diamond-drill boring was very greatly increased and a new ore-body was found and developed. This was sufficient to demonstrate that there was ore available to keep a concentrator of about 200 tons daily capacity in continuous operation for several months. There is also a "probable" tonnage of ore which might be sufficient to keep the mill running for some two or three years. This newly discovered ore assayed higher than the milling-ore in the old workings. Average samples ran between 2 and 3 per cent. in copper, with low gold and silver values.

After the new ore-body was found the concentrator was remodelled and electrified throughout. The daily capacity of the mill was increased to between 200 and 300 tons of ore. The electric machinery was introduced because of the excessive cost of coal fuel and the apparent feasibility of generating electricity by water-power. The water in the two creeks which flow across a portion of the property was utilized for power, and was expected to furnish sufficient power to run the mill, air-compressor, and lights for eight or nine months of each year.

These improvements were completed during the summer of 1920, ready to take advantage of the usual fall rains, but the usual quantity of rain did not arrive and it was impossible to run the plant.

During the winter of 1920–21 the price of copper fell so low that very many of the larger copper-mines in the United States closed down. This policy was followed by the Tidewater Copper Company and the property remained idle until March, 1922. Operations were resumed, attention being chiefly confined to the further development of what is known as the Price ore-body and preparations for stoping, so as to ensure the delivery of a continuous supply of ore to the mill at such time when sufficient water was available for the required power.

The autumn of 1922 was unfortunately dryer than usual, so that sufficient power could not be obtained for continuous operation. These conditions held until the management decided to install a 300-horse-power semi-Diesel fuel-oil engine in addition to the water-power.

During 1923 operations were carried on practically continuously by J. C. Abrams, superintendent, using water-power when possible and the oil-engine when the water-supply was insufficient. The low price of copper during the last few months was a serious difficulty.

Since 1916 the Tidewater Copper Company has expended a large amount of money for development, erection of the concentrator, with necessary equipment in machinery, the development of water-power, etc.

The milling practice was especially satisfactory, as while the feed-heads averaged from 2 to 2.6 per cent. copper, with quite low gold and silver values, the proportion of concentration was about 20 to 1, and the grade of the concentrates averaged: Copper, 42 per cent.; gold, 10 oz. to the ton of concentrates; silver, 6.75 oz. to the ton concentrates. During 1923 it is estimated that there were 40,000 tons of ore milled, which produced 1,600 tons of concentrates.

In the latter end of July, 1923, I visited the company's camp and examined the mine-workings. The underground development-work had extended the No. 3 adit 850 feet, thus connecting with the easterly end of the Price ore-body on that level. No. 3 adit is approximately 100 feet vertically below No. 2 adit, but the winze driven from No. 2 to No. 3 is on an incline

of about 25°. The known length of the Price ore-body on No. 2 level at the time of my visit was approximately 250 feet.

Stoping was being carried on from the floor of the incline to No. 2 level at the same time as the drifting on No. 3 level, so that that level could be used as the main haulage-level as the No. 3 drift-adit was advanced beyond the junction with the winze, which would be used to mine the ore between the No. 3 level and the incline.

Near the top of the incline on the No. 2 level a fault occurs which apparently cuts off the ore in that direction. A crosscut is being driven across the northerly end of the fault to prospect for the extension of the ore-body beyond.

The widest portion of this ore-body is fully 40 feet, maximum width measured half way between the No. 2 and No. 3 levels. The ore-body has been stoped above the No. 2 level to a vertical height of 87 feet and for a length of 200 feet along the strike. The width of the ore stoped varies from a minimum of about 10 feet to the maximum referred to, about 40 feet. No prospecting had been done at the time of my visit to determine whether or not the ore-body maintained continuity to any considerable depth below the No. 3 drift, and I was unable to make a later visit.

Beach Camp.—At the Beach camp there has been very little change since it was described in the Annual Report of 1922. The only important addition made has been the installation of a 300-horse-power semi-Diesel engine, also a wood-stave tank of 15,000 gallons capacity for storing fuel-oil.

QUATSINO MINING DIVISION.

The progress of mining in the Quatsino Division during 1923 has been more marked than in the past two years, and has been entirely in the extension of development-work on older locations rather than in records of new discoveries or production.

So far as the production of metalliferous minerals is concerned, there has been none from the Quatsino Division during 1923, but development-work is being extended, so that within a reasonable time there should be production of copper-gold-silver ores, with a possibility of zinc-gold-silver ore.

Old Sport Group.

This group contains altogether about forty mineral claims owned by the Coast Copper Company, a subsidiary to the Consolidated Mining and Smelting Company of Canada, Limited. The property was very fully described in the Annual Reports for 1916, pages 340 and 341, and for 1917, page 253; also by Victor Dolmage in Summary Report, 1918, Geological Survey. It is therefore not necessary to make a repetition in this present report. Development-work on this property was suspended in 1921 and was resumed in April, 1923.

The development-work carried on has been a continuation of the drift south on the *Old Sport* vein from the lower adit with the object of eventually making a connection by an upraise with the winze from the upper workings. The lower adit is driven from the shore of Elk lake above high-water and 475 feet vertically below the outcropping, or 800 feet on the 37° dip of the *Old Sport* vein.

The footage driven to the end of October last was 675 feet. In addition to this the necessary annual assessment work has been done on all the unCrown-granted claims in the various groups which comprise the entire property that may be termed the *Old Sport* mine.

Before this property can be placed on a producing basis it will be necessary to construct a railway to connect the property with the sea-coast, either on Quatsino sound or at some point on the east coast of Vancouver Island, and, although several preliminary surveys have been made, it has not yet been decided which point will be the ocean shipping-port. It will also be necessary, owing to the comparatively low grade of the ore which carries gold-silver-copper values, to construct a concentrating plant in which to treat the ore previous to smelting.

Millington Group.

This group contains six mineral claims known as the *Crackle Jack*, *Molloy-ton*, *Hood*, *Molly B.*, *Molloy Baker*, and *Pay-streak*, owned by Skinner Bros., E. Peterson, P. Obling, and J. Bell, all of Holberg. The group was fully described in the Annual Report for 1919, page 267, and for 1922 page 232. During 1923 the owners continued the underground development-work by extending the west drift from the lower adit and also the east drift. This work, I am reliably informed, has exposed new bodies, but I have not had an opportunity to make an examination since this development was completed.

With regard to this property, it is interesting to note that samples taken by myself from on and near the surface assayed as high as 21 per cent. copper, but in the lower levels the copper content was only 2.1 and 2.5 per cent.

The owners of the *Millington* group have shown great faith in the property and have done much more development-work than is usually found in the average prospect.

Zinc Ores.—At a point about 6 miles easterly from June Landing on the South-east arm of Quatsino sound there occur some deposits of zinc-blende ore, samples of which assay as high as from 37 to 46 per cent. zinc. The prospects are still owned by the original locators, who during 1923 had expectations of being able to sell. The properties were examined by William Clancy, who was at that time manager for the Coast Copper Company.

These prospects were fully described in the Annual Report for 1916, page 342. Although some further work has been done it has not affected the general conditions on the prospects to any marked extent.

NANAIMO MINING DIVISION.

The Nanaimo Mining Division covers a greater area, both on Vancouver island and the Mainland, including several islands lying between, than any other Mining Division in the Western District.

The mineral resources of the Division comprise coal; gold-silver-copper ores; magnetite-iron ore; limestone; building-stone, including granite, sandstone, and andesite; also excellent clay and shale adaptable for brick-making.

All the operating coal-mines on Vancouver island are in the Nanaimo Division. Full and detailed reports of these will be found in this report under the heading "Inspection of Mines," so no further reference will be made in my report.

It is to be regretted that there has been no production from the metalliferous mines in this Division during 1923, except a limited quantity of magnetite-iron ore from the *Good Hope*, on the east side of Texada island, owned by the Pacific Steel Company, of Seattle, and managed locally by Harry Walbran.

A limited quantity of limonite-iron ore was shipped from the limonite-deposits near Alta lake, on the Pacific Great Eastern Railway. This was used in the gasworks of Vancouver and Seattle for the purpose of purifying gas by absorbing the sulphur.

Although this is the only production from the metalliferous-mineral prospects in the Division during 1923, the owners of partially developed mineral claims have, in several instances, been working on their properties and have extended the development-work previously done in the hope that the representatives of individual capital may find some propositions sufficiently attractive to merit thorough investigation.

QUATSE LAKE SECTION.

The Quatse Lake section of the Division is about midway between Coal Harbour, on Quatsino sound, and Hardy Bay, on the north-east coast of Vancouver island. Coal Harbour and Hardy Bay are connected by a trail about 10 miles in length, first used by Indians many years ago as a short cut between the east and west coasts over the very low divide which separates the waters flowing into Hardy bay from those flowing into Quatsino sound.

About twenty-five years ago the Indian trail was reconstructed, but its use was limited until after the organization of the Whalen Pulp and Paper Company at Port Alice, on Quatsino sound. Since then several attempts have been made to build a wagon-road in place of the old trail, now often almost impassable owing to mud-holes, etc. Up to the present time these attempts have been only partly successful. A wagon-road has been graded from Hardy Bay to the Quatse river, about 4 miles, also from Coal Harbour for a distance of about 2 miles; for the remainder, about 4 miles, the old trail is still used, but it is expected that during 1924 the road will be completed.

During the past ten years considerable travel has passed over this route. The letter mail is carried over it three times weekly, having arrived at Hardy Bay direct from Vancouver, whereas by the west coast steamer there are only three mails monthly. The route is also much used by the employees at Port Alice and the *Old Sport* mine, as well as logging camps, instead of that by the west coast steamer.

The section has been prospected intermittently for several years, and this has resulted in the location of the *Caledonia* group near Quatse lake, and mineral claims in the vicinity of Kains lake, about 5 miles north-westerly from Quatse lake.

This north-westerly section of Vancouver island, although mountainous [illegible] really high peaks, such as are found in the central portion of the island at the heads of the rivers emptying into Kyuquot, Nootka, and Clayoquot sounds.

The predominating rocks in this section belong to the Vancouver group as described by Dawson, Clapp, and Dolmage, and include andesites, tuffs and basalts interbedded with limestone. There are also rocks representative of the Coast Range batholith, which vary in composition from granites to true diorites; quartz diorites and granodiorites being the most abundant.

Caledonia Group. This group contains the *Bluebell*, *Cascade*, *Caledonia*, *Scotia*, *Maple* and *Thistle* claims, located in one block through which Caledonia creek flows in a southerly direction into Quatse lake, about 2 miles from the group. The owners of the group are T. D. Harris and Robert A. Grierson, of Hardy Bay, and Mr. and Mrs. Murray C. Potts, of Alert Bay.

Geology.—On the *Caledonia* group there is a well defined contact between the limestone and granodiorite, the limestone being very much altered. This has resulted in extensive beds of garnet and epidote rock near the contact, and it is noticeable that the mineralization on this group occurs at and near such contact.

There occur on the property several intrusive dykes, apparently true diorites, some of which cut the beds of altered limestone and apparently have an influence on the mineralization.

The minerals found on the *Caledonia* group are galena, zinc blende, iron pyrites, some chalcopyrite, magnetite, and some pyrrhotite in a gangue of altered limestone in which occur much garnet and some epidote.

Ore-deposits.—The deposition of ore on the *Caledonia* group appears to occur as ore-bodies with lenticular structure which occur along a line of strike in a north-westerly direction following closely to the line of contact between the granodiorite and limestone. The dip of the ore in the present shallow workings varies, but is nearly or quite vertical. The width of what may be termed the mineralized lode matter varies from 3 to 10 feet and in the bed of Caledonia creek reaches a maximum of about 30 feet.

The values, as shown by samples taken from the workings, vary as follows:

Sample No. 1, *Caledonia*, assayed: Gold, trace; silver, 0.6 oz. to the ton; copper, *nil*; across 3 feet.

Sample No. 2, *Caledonia*, assayed: Gold, trace; silver, 19 oz. to the ton; copper, 3.2 per cent.; across 9 feet.

Sample No. 3, *Cascade*, assayed: Gold, 0.04 oz.; silver, 0.2 oz. to the ton; copper, 0.5 per cent.; iron, 61.5 per cent.; manganese, *nil*.

Sample No. 4, *Cascade*, assayed: Gold, trace; silver, 16 oz. to the ton; copper, 3.2 per cent.; zinc, 10 per cent.; a grab sample from an outcropping apparently about 30 feet wide in the bed of Caledonia creek.

Development-work.—The development work that had been done up to the time of my examination consisted of stripping and open-cutting on the *Cascade* mineral claim on the westerly side of Caledonia creek and near the easterly boundary of the claim; an adit of about 50 feet driven in granodiorite country rock on the *Caledonia* which was projected to crosscut the ore-body that outcrops in the bed of Caledonia creek, but this has not been driven sufficiently far to effect that purpose.

Open-cut No. 2 on the *Cascade*, about 300 feet west from Caledonia creek. This cut is about 30 feet long, 10 feet deep at the face, and crosscuts 9 feet of ore as represented by sample No. 2.

Open-cut No. 3 on the *Cascade*, 31 feet long and 12 feet high at the face. This cut is through overburden to near the face where bed rock is exposed, slightly mineralized in the floor of the cut, the appearance of which indicates that ore will probably be exposed below it.

In addition to the above-described work there has been stripping and surface prospecting done on the *Scotia*, *Maple*, and *Bluebell* claims.

STRATHCONA PARK SECTION.

Strathcona Park section of the Division comprises the area within the boundaries of Strathcona Park bounded on the north by the mountain range which forms the divide between the Salmon river, flowing northerly, and the Gold river, flowing south-westerly; on the east by the western boundary of the Esquimalt & Nanaimo Railway land grant; on the south by a line extending westerly from the western boundary of the Esquimalt & Nanaimo Railway land grant to near the head of Herbert arm, Clayoquot sound. Most of the area included in Strathcona Park lies in the practically unexplored portion of the interior of Vancouver island.

For several years after the Strathcona Park Reserve was gazetted no prospecting was allowed within its boundaries; this reserve, however, was removed in 1917, since which time the Paramount Mining Company acquired title to about forty mineral claims on Myra and Price creeks. This company, under the management of Joseph Errington, in 1919 and 1920 states that there was expended approximately $40,000 in diamond-drilling, driving adits, and surface prospecting on two groups of mineral claims known as the *Paw* and *Lynx* groups, which work I examined in 1920 and described in the Annual Report for that year. Since then the company has Crown-granted four claims in the *Paw* group and eight claims in the *Lynx* group, having also done assessment-work on several other claims of the two groups. The work has demonstrated that there is a very extensive body of low-grade ore, the principal value being in copper. The company has not yet attempted to open up any of these claims owing to the unsatisfactory state of the copper market and difficulties of transportation to a Coast smelter.

At the present time this property is reached from Campbell River settlement near Seymour narrows, on the east coast of Vancouver island, by means of an auto-road about 10 to 12 miles; horse-trail about 6 miles to near the foot of Upper Campbell lake; rowboat or canoe about 4 miles up the lake, and horse-trail from there to the foot of Buttle lake, about 9 miles. Buttle lake, which is navigable for scows and light-draught gas or steam boats, has a length of 22 miles to the mouths of Myra and Price creeks at the head. The group of mineral claims are about a mile from the lake-shore. The claims are admirably located as regards possible water-power to run all machinery. The supply of timber for all purposes is ample.

In addition to the work done by the Paramount Mining Company, a portion of the south-easterly part of Strathcona Park has been prospected to some extent during the past year by W. J. Wainwright, of Cumberland, who has recently brought in samples of copper sulphide, pyrrhotite, and stibnite ores, which he reports he obtained between Comox lake and the heads of Ralph and Shepherd creeks.

FREDERICK AND PHILLIPS ARMS SECTION.

Frederick and Phillips arms penetrate the mainland coast opposite to the north-west end of East Thurlow island. In this section of the Division there was extensive mining development from 1898 to 1902, when the gold-bearing quartz veins on the *Dorotha Morton*, *Bluebell*, and *Alexandra* mines were all being extensively developed. On the *Dorotha Morton* there was installed a Bleichert tramway, a Morrison high-speed mill, cyanide plant, and ore-bins. The production from this mine was approximately $110,000 in gold bullion.

From about 1902 to 1923 this section has been idle so far as mining is concerned, but during the past year efforts have been made to resurrect mining. Although development-work had been done on the *Alexandra* and *Colossus* (now known as *Lagoon*) groups, there has been no actual production of ore.

Alexandra Group. A force of miners was at work on this group cleaning out the old workings. It has been leased and bonded to Beaton & Hemsworth, of Vancouver, who have the old mine-workings in good shape for examination. The group was described in the Annual Report for 1921.

Sunbeam Group. During the past year the Nimrod Mining and Development Company was organized by Richard F. Hill. This company acquired the claims comprised in the *Sunbeam* group under titles stated to be clear with all taxes paid to date and the annual assessment-work done on the un-Crown-granted claims, and recorded up to June 1st, 1924. The *Sunbeam* group is located from the beach on the west side of the entrance to Frederick arm up the mountain side to the vicinity of the old *Bluebells* group of mineral claims, on which quite extensive development-work was done from about 1898 to 1902. The

mountains rise very steeply from the shore to the *Ohio* claim, which is a distance of approximately 1 mile, in which the elevation reaches approximately 2,000 feet above sea-level, and as is usual along the coast-line, the mountain-side is heavily timbered.

The geologic formation on the *Sunbeam* group is very similar to that on the adjoining *Bluebells* group. The structure and character of the predominating rock in the mineral-bearing zone apparently represents an example of a roof pendant inclusive in the Coast Range granodiorite batholith which was not destroyed at the time of the intrusion of the granodiorite. The predominating rocks on the property are metamorphosed shale, schist, argillite, limestone, and tuff, which formation is traversed by veins which vary in thickness and reach the maximum width of about 40 feet where exposed by development-work on the *Bluebells* group.

The ore-deposits on the *Sunbeam* group occur as gold-bearing quartz veins with the line of strike N. 35° W. and dip 80° south-westerly. The mineralization consists of some free gold on and near the surface and gold values associated with iron pyrites below the surface. The gangue in the veins is quartz. No samples have been taken by myself from this property.

The development-work done on the *Sunbeam* group has been confined to prospecting and trenching to trace the continuity of the mineralized zone and to prove that such is an extension of the zone developed on the *Bluebells* claim.

Lagoon Group. This group was formerly known as the *Colossus* and was developed by the Kamloops Mines Company, Limited (Joseph Argall, superintendent). Operations were carried on by that company from 1896 to 1906, when work was discontinued. The group contains the Crown-granted mineral claims *Colossus*, *Rio Tinto*, *Bluebell*, *Portage*, and *Champ Ness Fraction*, which had reverted to the Crown on January 5th, 1921, on account of non-payment of taxes. Since then they have been acquired in 1922 under the "Mines Development Act, 1916" (which provides for the granting of leases by the Government to prospectors on reverted Crown-granted claims), by Dixon & Rowley, of Vancouver. Since then the lessees staked a claim called the *Lagoon* which adjoins the original group, and have called the group the *Lagoon* instead of *Colossus*. I examined the property in May, 1923.

Location.—The *Lagoon* group is situated near the head of Buker creek, which empties into Estero basin. The property is reached by one of the steamers of the Union Steamship Company, of Vancouver, which plies from Vancouver to Shoal Bay settlement on East Thurlow island, and from there by launch or rowboat to the head of Frederick arm and into Estero basin at flood tide, the only time when the narrows are navigable even for small boats.

The distance from the mouth of Buker creek to the mine workings is about 2 miles by horse-trail, but at the time of my visit it was very much out of repair and the main bridge crossing Buker creek had been carried out by high water. Buker creek is a torrential stream, the fall between the mine-workings and the mouth of the creek being approximately 1,240 feet.

Geology.—The geologic formations on the *Lagoon* group of mineral claims are quite complex; the original structure has been affected very considerably by erosion and volcanic disturbance, as well as by intrusive dykes of a blackish fine-grained igneous rock. The predominating country rock resembles a true diorite, associated with which are several metamorphosed rocks, some of which are apparently altered sedimentaries, including limestone. Shearing movement has extended a strong influence over the structure of the rock formations and the shattered condition of much of the granodiorite, as is shown in a long adit, known as No. 2 level.

Ore-deposits.—There appear to be several occurrences of ore on the *Lagoon* group. These ore-bodies are lenticular in structure and very erratic; the extent of the lenses is undetermined generally speaking, and a very close study of the formation is necessary to carry on development work to the best advantage. The line of strike is generally westerly and the dip nearly vertical. The igneous dykes appear to have influenced the deposition of the mineralization to a considerable extent.

According to a long list of assays made from samples taken by Dixon & Rowley, the present owners, it is shown that the ore-bodies exposed in the underground workings will average between 4 and 6 per cent. copper, but the majority of samples assayed less than 4 per cent.; it would appear, therefore, to be undesirable to attempt to smelt the ore direct. The oil flotation method should, however, give very good recovery.

The examination made showed me that the ore-bodies averaged approximately 6 feet in width. I did not attempt to do any sampling, but accepted the following results from samples taken by Dixon & Rowley as being fairly representative of the copper values carried by the ore:—

"*West Ore-body*—

	Width in Feet.	Per Cent. Copper.
No. 1	4	2.3
„ 2	4	9.5
„ 3	9	5.0
„ 4	6	2.9
„ 5	8	2.7
„ 6	4	4.17
„ 7	9	3.8
„ 8	16	3.8

Average of eight samples, 4 per cent.

	Width in Feet.	Per Cent. Copper.
No. 9	7	9.0
„ 10	8	2.5
„ 11	2	18.0
„ 12	4	2.7
„ 13	7	5.3
„ 14	8	3.2
„ 15	6	3.9
„ 16	4	6.3
„ 17	8	8.5

Average of nine samples, 5.7 per cent."

Development-work.—The *Lagoon* group has been developed on four levels: The No. 1 about 100 feet below the outcroppings, which occur at an elevation of about 1,400 feet above sea-level and in the wall of a deep canyon between high precipitous bluffs; the No. 2 level 90 feet below the No. 1; the intermediate level 56 feet below the No. 2; and No. 3 level 155 feet below the No. 2.

No. 1 is a crosscut adit 161 feet long, with a drift to the east 76 feet long and another to the west 182 feet. On the No. 2 level is a crosscut adit, with crosscuts and drifts, totalling about 690 feet in length. On the No. 3 level the main adit has been driven about 900 feet as a crosscut through country-rock, at which point mineralization commences to show. The ground is very soft and difficult to hold through the mineralized zone. The adit has been driven about 100 feet beyond where minerals were first exposed to a fault which dips about 10° to the north-westerly and apparently cuts off the mineralization. Two drifts have been driven towards the west, the No. 1 being about 50 feet long and the No. 2 about 100 feet long.

Lasqueti Island Section.

Although there was no production of metalliferous minerals from Lasqueti island during 1923, considerable prospecting was carried on by the Kurtzhals Bros. on the *Juneau* group, which contains the *Juneau*, *Morore*, *Kim*, and *Ohm*, situated westerly from the *Venus* group, which was described quite fully in the Annual Report for 1920.

The contact between the diorite porphyry and diorite which occurs on the *Venus* group, adjoining the *Juneau* group on its easterly side, has been located, I am informed, by the Kurtzhals Bros., on the *Juneau* group, and at and near that contact ore-bodies have been exposed, the mineralization of which is chiefly chalcopyrite.

I did not during 1923 visit Lasqueti island and examine the *Juneau* group, but the fact that the owners had Crown-granted the property during the past year would indicate that they have considerable confidence in the prospective value.

Texada Island Section.

Notwithstanding the fact that since the closing-down of the *Marble Bay* mine in 1921 production of metalliferous ores has ceased, with the exception of a limited quantity of magnetite from the *Good Hope* mineral claim on the east side of Texada island, there was during 1923 considerable prospecting done on the west side of the island in the vicinity of Surprise mountain. Most of this was done on the *Nancy Bell* group. Some work was also done by John McConville on the *Old Victoria*, near Kirk lake, which claim was developed to some extent previous to 1908, when it was examined by R. G. McConnell, of the Geological Survey of Canada, and reported on in Memoir 58, "Texada Island, B.C."

The limestone business has been quite brisk during 1923. This is represented by the Pacific Lime Company at Blubber bay and the Powell River Pulp and Paper Company, which latter corporation acquired the quarries at Sturt bay from the Tacoma Steel Company, the owners of the old *Marble Bay* mine.

Nancy Bell Group.

This group contains three Crown granted mineral claims known as the *Nancy Bell* (Lot No. 46), *Silver Tip* (Lot No. 44), and *Thuce* (Lot No. 105). This group is owned by William McDonald, of Vananda; Hugh McMillan, of Nanaimo; and the estate of the late William Lee, of Vananda, and Buckley, Washington, who were carrying on development until last spring, when the property was bonded to A. C. Merrill, of Tacoma, Washington, who was extending the development work already done when I examined the prospects on April 16th, 1923. The group was very fully described in the Annual Report for 1921, also in the Report for 1922; the present report will therefore only refer to a description of the extension of the development work as examined during my last visit.

Development-work.—The depth of the shaft sunk by Lee, McDonald & McMillan on the *Nancy Bell* had been increased to about 37 feet, and it was proposed by Superintendent Larsen to continue sinking to a depth of 100 feet, at which point a station would be cut, from which drifting and crosscutting would be done in order to determine the extent and value of the prospect at that point.

Assays.—The following is a list of assays made from samples taken by myself at the time I made my examination:—

Description.	Gold.	Silver.	Copper.	Zinc.
	Oz.	Oz.	Per Cent.	Per Cent.
No. 1. Sample from last shots fired at bottom of shaft	Trace	1.0	Nil	1.5
No. 2. Sample from north-westerly end, bottom of shaft, close to hanging wall side	Trace	0.6	Nil	2.0
No. 3. Sample from across 3 feet south-easterly side, bottom of shaft	0.10	0.8	Trace	7.0
No. 4. Sample from dump at collar of shaft, ore sorted for shipping	0.70	6.5	1.5	10.0
No. 5. Sample from dump at collar of shaft, ore sorted for shipping	0.64	6.6	3.0	20.0
No. 6. Sample from across 4 feet north-west end of shaft average	0.08	1.0	Nil	1.5
No. 7. Sample from dump at collar of shaft, ore sorted for shipping	0.54	4.0	2.7	20.0
No. 8. Sample from open-cut at south-easterly part of Nancy Bell claim	0.26	1.0	Nil	1.5

From a study of the above list it will be seen that while a certain proportion (undetermined) of the ore in this shaft can be sorted so that it would carry satisfactory commercial values, yet the values in the ore-body taken as a whole would indicate that concentration is desirable rather than direct smelting.

Transportation Facilities.—The transportation facilities which offer for the handling of ore from the *Nancy Bell* group to the east coast of Texada Island are decidedly poor, as under the present conditions it will be necessary to haul ore from the present mine-workings over a steep ridge of Surprise mountain to the junction of the main Vananda Iron Mine wagon road and the trail from the *Nancy Bell*, a distance of about 1½ miles. This junction is on the *Nigger Baby* claim near the cabin, which route from Surprise mountain to the *Nigger Baby* cabin was established about 1896; since then very little repair or construction work has been done, so it is in bad order for hauling heavy loads.

The most convenient route for transportation would be by constructing a wagon road from the *Nancy Bell* shaft and following a depression which crosses the *X Ray* group and the *Nigger Baby* claim to a convenient point on the Vananda Iron Mine wagon road. The distance from the *Nancy Bell* mine-workings to Vananda, on the east coast of Texada Island, is about 6 miles.

Another route by which ore can be transported is from the *Nancy Bell* to tide water on the west coast of the island, where a concentrating plant was erected a few years ago, in which it was proposed to treat the ore from the *Retriever* group on Surprise mountain. The distance between the terminal points of this route would be about a mile, but there is no shelter at the concentrator site, and in consequence shipments of ore or concentrates would be interfered with.

Good Hope.

This mineral claim is situated on the east coast of Texada island, on the south side of Raven bay, about 4 miles southerly from Vananda Post-office. The property is owned by the Pacific Coast Steel Company, of Seattle, whose local manager is Harry Walbran, and was examined as a prospect by myself in 1917, the description being given in the Annual Report for 1917. At that time the *Good Hope* was owned by the original locator, Harry Walbran. Since then so much work has been done and quite a considerable tonnage of magnetite-iron ore shipped that during a visit to Texada island in April last I considered it advisable to make another examination, the result of which is given below.

Location.—The *Good Hope* is most admirably situated from a shipping standpoint, as it is only about 250 feet from the coast-line to the portal of the main adit at about 115 feet elevation above sea-level.

Geology.—The country-rock in the vicinity is porphyrite, and the ore, which is chiefly magnetite with which is associated some chalcopyrite, is formed along a well-defined line of fissuring in the porphyrite at a distance of approximately 3 miles from the nearest occurrence of limestone. This ore-body, although lenticular in structure, should be included in the fissure-vein type of ore-bodies rather than in the contact-metamorphic type, which is so general in the north-eastern portion of Texada island, especially in the case of the deposits of copper-sulphide ores, such as the *Marble Bay, Copper Queen, Cornell*, and others.

Development-work.—The mine has been opened up and developed since it was acquired by the Pacific Coast Steel Company, of Seattle, as a producer of magnetite-iron ore. The development-work consists of four levels; the two upper being open-cuts each about 100 feet long, and with the upper one about 20 feet above the No. 2; the No. 3 level was started as a short adit in the side-hill to a point where the magnetite ore was exposed about 20 feet below the Nos. 1 and 2 open-cuts. From this point the ore was stoped down for a distance of about 100 feet along the strike.

The No. 4 level was being driven at the time of my examination. An adit was also being driven under the No. 3 adit, about 20 feet below it, but had not been driven far enough to expose the ore-body. The average width of magnetite in the vein is about 11 feet, but in some portions of the workings a much greater width has been reached. The No. 4 level is approximately 75 feet below the outcropping.

In addition to driving the No. 4 level, Mr. Walbran is building a new bunker on the shore. This is connected with the face of the No. 4 adit by an incline 3-rail tramway, by which means ore is transported from the mine to the bunker. There it is loaded into scows and towed to Seattle for treatment in the plant of the Pacific Coast Steel Company.

The production since 1917 has been at the rate of approximately 1,000 tons of magnetite annually. Mr. Walbran proposes to test the continuity of the magnetite-ore body to a greater depth.

Limestone.

During 1923 the industry of quarrying limestone has been carried on continuously at two points on the northerly end of Texada island—namely, Blubber bay and Sturt (Marble) bay. In R. G. McConnell's report, Memoir 58, he refers to the limestone of Marble Bay formation as affording an almost unlimited supply of material for the manufacture of lime, and states that the less-altered varieties as a rule are the freest from deleterious impurities. As evidence of this fact he quotes the results of two partial analyses made by H. A. Leverin, of the Department of Mines, which gave the following results:—

	Magnesian Limestone.	Ordinary Variety.
Calcium carbonate	(1) 85.00	(1) 98.39
Magnesium carbonate	(2) 11.32	(2) 0.71
Ferric oxide and alumina	2.16	0.30
Insoluble matter	1.26	0.20
	99.74	99.60
Equivalent to lime CaO	(1) 47.60	(1) 55.10
Magnesia MgO	(2) 5.42	(2) 0.34

Pacific Lime Co.—The location of this company's workings is at Blubber bay, a sheltered harbour at the north-westerly end of Texada island. The bed of limestone which occurs at this

point is of very great extent, as is shown by the fact that two quarries have been opened up, one of which has practically been in continuous operation since about 1910. The dimensions of this quarry are 400 feet long by 150 feet wide by 70 feet deep, with the floor of the quarry still in limestone, which apparently maintains its continuity to a much greater but undetermined depth.

At the face of this quarry there occurs a wide diorite-porphyrite dyke which has been driven through by a tunnel about 100 feet long to where a second limestone-quarry was started and at the time of my examination in April, 1923, was being worked to an extent of about half the dimensions of the first quarry.

Products.—The limestone quarried furnishes two products; one being lump stone which is shipped to the Granby Consolidated Mining, Smelting, and Power Company at Anyox for flux in the copper-smelters there, and the other product being hydrated lime which is shipped in barrels principally for export trade.

This Pacific Lime Company employs an average of 140 men, which includes miners employed in the barrel-factory, the sawmill, and around the wharves.

Until about two years ago the Pacific Lime Company shipped a considerable tonnage of lump magnesian limestone to the pulp and paper mills of Powell River for the manufacture of sulphite but about that time the Powell River Company purchased the limestone-quarries at Sturt Bay from the Tacoma Steel Company, and since then has discontinued receiving rock from Blubber bay, but has been operating the Sturt Bay quarry on its own account.

In addition to the two quarries mentioned, there were two others in operation some years ago, one adjoining the quarry of the Pacific Lime Company, and the second one on the north-west coast of Texada Island, but both of these have been idle during recent years.

Gem Group. This group contains five claims, known as the *Gem*, *Dandy*, *Harold D.*, *Gerald D.*, and *Crackerjack*, all fractions and Crown-granted. The group is owned by Logan & Danaher, of Vancouver, and is at present being worked under a lease and bond by John McConville, of Vancouver. The *Gem* group was originally the old *Nutcracker* group, located about three-quarters of a mile from Kirk lake, being easterly of and adjoining the *Victoria*.

Geology.—The prevailing country-rock in this section of Texada Island is porphyrite in which occurs many quartz veins, usually narrow, mineralized with free gold near the surface.

Development.—During the past summer the old workings on the *Gem*, opened up twenty years ago and since practically abandoned, were reopened and extended. The extension of the underground workings consist of a drift from the bottom of an old shaft about 70 feet deep on a quartz vein about 5 feet in width. This drift follows the vein for 80 feet, along 60 feet the quartz carries gold values varying from low grade to quite high grade.

Mr. McConville proposes to extend the workings and install a mill in the near future.

TATLAYOKO LAKE AND KLINAKLINI RIVER SECTIONS.

The northernmost part of the Nanaimo Mining Division, situated on the Mainland, embraces the watersheds of the Southgate and Homathko rivers, which empty into Bute inlet, together with their tributaries, also the watershed of the Klinaklini river, which empties into Knight inlet.

From the heads of the inlets mentioned travel into the Interior is not an easy matter for canoes or rowboats can only be used in certain parts of the rivers. This section is reached of necessity by way of the Chilcotin, travelling over the Pacific Great Eastern to Williams Lake, from there crossing the Fraser river at Chimney Creek bridge by good auto-road to Alexis Creek and from there to the head of Tatlayoko lake. To reach the mineralized zone on the Klinaklini river an automobile can be driven to One Eye lake, within about 20 miles of the mineral bearing zone on Chromium and other creeks tributary to the river.

The development work done by the Tatlayoko Lake Gold Mining Company on a group of claims on the Homathko river, the outlet of Tatlayoko lake, had not been extended to any appreciable extent since 1921, when it was fully described in the Annual Report. The claims owned by the company are known as the *Tatlayoko*, *Tyee*, *Copper Duke*, *Copper Duke Extension*, *Isaac T.*, and *Spokane*, all Crown-granted. Thomas Morris, who had been superintendent of the property at the time of my visit in 1921, was temporarily absent during my visit in 1923 and the camp closed down, pending, as I was informed, a reorganisation of the company.

A few prospectors had been exploring the mountains in the vicinity of the headwaters of the Homathko river, but had left that section shortly before my visit and were then prospecting in the Taseko section, in the Clinton Mining Division.

In the Klinaklini River section Samuel Caldwell, of the Klinaklini telegraph-station, a veteran prospector and discoverer of the hæmatite-iron ore on Chromium creek, was away during my visit and the result of his trip I have not yet learned.

Jump Creek Section.

Jump creek is one of the tributaries of the Nanaimo river, which is often referred to as the South fork of the Nanaimo river. The stream drains a rugged mountainous section between the Nanaimo river and Cowichan lake.

The Jump Creek section is of considerable extent and from a metal-mining point of view should be quite an attractive field for prospectors, as samples of the ore found in that section all show good gold and silver values. The section was described in the Annual Report for 1922 and there have not been any very notable changes since.

Development-work has been carried on during 1923 on the *Silver Leaf* and prospecting has been done to a considerable extent in the mountains at the headwaters of the tributaries of Jump creek. During 1923 I was unable to visit the section.

Placer-mining.

For the past several years prospecting has been done for placer around Cape Sutil and the Nahwitti river, at the north-west end of Vancouver island, but up to the present time no results of a commercial character have been produced.

For several years past the settlers around Fisherman cove, Cape Scott, and the Nahwitti river have been securing some placer gold, which is found associated with black sand on the beaches along the shore-line.

During 1921 ten placer leases were granted for areas in Townships 23, 24, 25, and 19, near Cape Sutil, and others applied for were for areas in the vicinity of Fisherman cove.

There were sixteen placer-mining leases issued altogether, but to-day there are only eight of these leases in good standing, and there has been no product from any of them that could be considered of a commercial character.

NEW WESTMINSTER MINING DIVISION.

During 1923 mining in the New Westminster Mining Division has been confined to the reopening of the copper-sulphide deposit on Pitt lake formerly known as the *Golden Ears*, but renamed the *Viking* group a few years ago. Considerable prospecting has also been done in the vicinity of the head of Chilliwack lake, as well as on Nasakwatch (locally called Middle) creek, Pierce mountain, in what may be termed the Chilliwack River section.

The *Lucky Four* was fully described in the Annual Report for 1918, also for 1919, and as only the annual assessment-work has been done since it is unnecessary here to repeat these reports.

Viking Group.

This group was examined by myself in 1923. The property, originally known as the *Golden Ears* group, is now owned by the Viking Mining Company, Limited, and was prospected to a considerable extent about 1908, but work was suspended until 1915, when the Viking Mining Company, now non-existent, erected an aerial tramway from the mine to a bunker on Pitt lake.

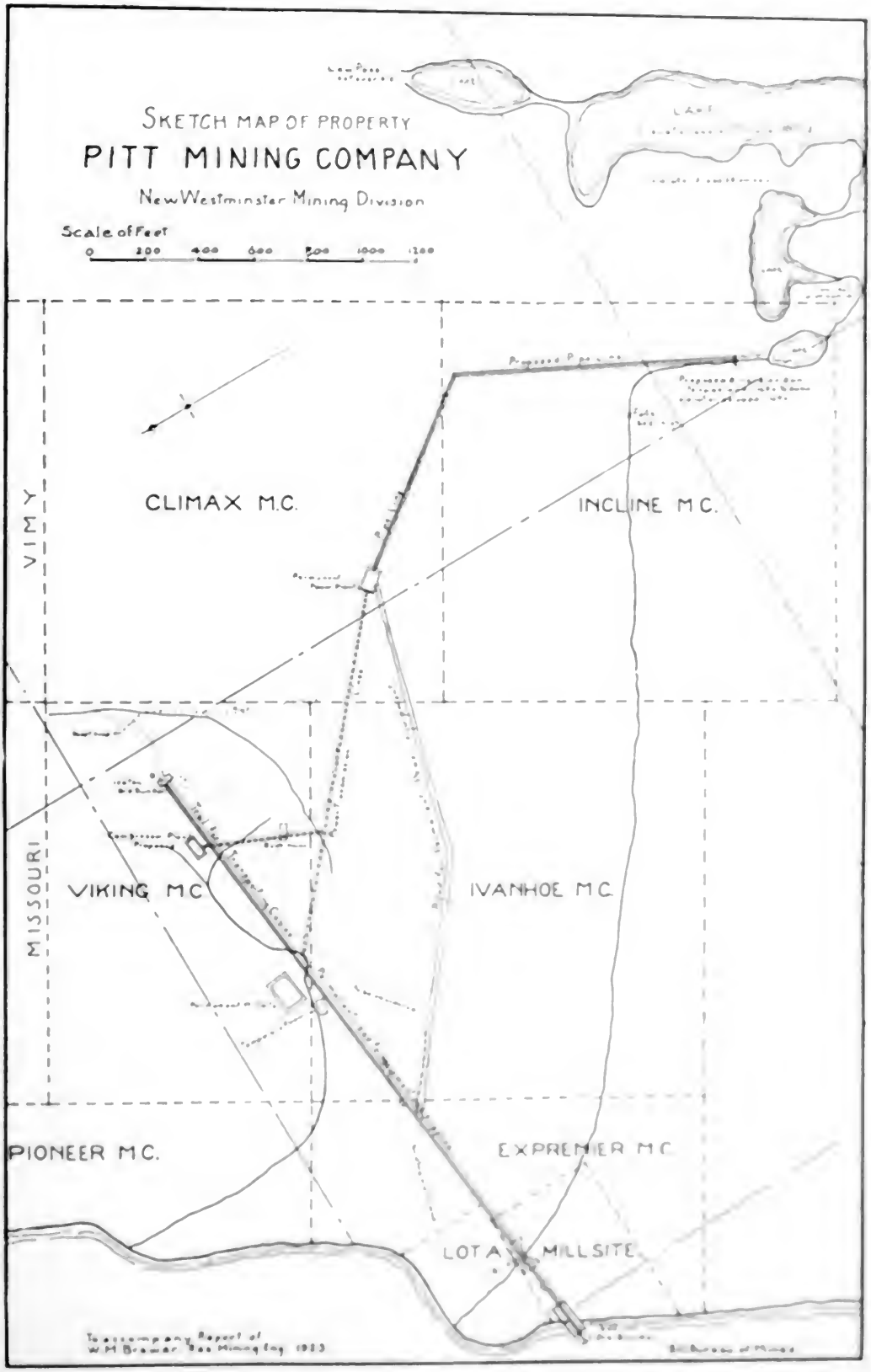
A small shipment made to the Tacoma smelter in June, 1914, of 2 tons showed: Gold, trace; silver, 5.46 oz. to the ton; copper, 11.39 per cent.

Another small shipment of 10 tons in July, 1914, showed: Gold, trace; silver, 4.76 oz. to the ton; copper, 10.27 per cent.

Another small shipment made in 1914 of 9 tons showed: Gold, trace; silver, 4.38 oz. to the ton; copper, 9.62 per cent.

During 1916, I am informed a shipment of 162 tons was made to the Tacoma smelter, which assayed: Gold, 0.02 oz.; silver, 2.5 oz. to the ton; copper, 4.1 per cent.

The more recent history of this property is the organization in 1921 of the Pitt Mining Company, Limited, by William Henry Woolley *et al.*, all of Vancouver, with a capital of $250,000.


SKETCH MAP OF PROPERTY
PITT MINING COMPANY
New Westminster Mining Division
Scale of Feet
0 200 400 600 800 1000 1200
CLIMAX M.C.
INCLINE M.C.
VIMY
VIKING M.C.
IVANHOE M.C.
MISSOURI
PIONEER M.C.
EXPREMIER M.C.
LOT A
MILLSITE

The registered office of the company (W. H. Woolley, president) is 25 Hastings Street East, Vancouver.

Geology.—The *Viking* group of mineral claims is situated in the Coast Range granodiorite batholith in a shear-zone where there has been apparently shearing and fissuring.

Ore-deposits.—The strike of the fissuring is nearly east (mag.), with the dip about 80° towards the south. There are apparently at least two mineral-bearing veins on the *Viking*. These veins are filled principally with quartz, calc-spar, some kaolin, and brecciated wall-rock, which vein-filling forms the gangue of the ore-body that is mineralized with pyrrhotite, pyrite, chalcopyrite, a little covellite, and occasionally some sphalerite.

These veins are enclosed within granodiorite walls on the surface, but in the underground workings an igneous dyke occurs about 380 feet from the portal of the main (or No. 1) adit, which apparently forms the foot-wall of the main (or No. 1) vein. Easterly from the portal of the No. 1 adit, at a point about 300 feet from the portal, a fault-zone is encountered.

Development-work.—The development-work on the *Viking* consists of the main (or No. 1) drift-adit, about 550 feet long, with short crosscuts from it; an upraise from the floor of the main adit to the surface, 180 feet high, with two short drifts—the lower one 90 feet above the floor of the adit and the other 45 feet higher. Small stopes have been opened on the 45-foot level, on the 90-foot level, and at two points in the main adit.

In addition, development consists of ore-bunkers, one on Pitt lake with a capacity of 400 tons being increased to 600 tons, and one near the portal of the main adit with a capacity of 100 tons; also an aerial-tram right-of-way cleared to connect the bunker on the shore with mine-workings.

Ore Tonnage.—It can be estimated that there is already blocked out on the *Viking* group approximately 16,000 tons of ore, but this estimate is only a rough one and subject to revision when actual mining operations are carried out. The quantity would be greatly increased if the ore is found to be continuous beyond the present face of the main adit, where the height above the adit increases practically a foot for every foot advanced underground, owing to the precipitous contour of the mountain in which the drift is being driven. In the estimated tonnage given no allowance has been made for the maintenance of the continuity of the ore below the level of the main adit.

Conclusions.—After as careful an examination as time permitted of the *Viking* group, I formed the opinion that, judging from the ore exposed in the underground workings in conjunction with the promising possibilities, the property possesses very many attractive features and is well worth further development.

Silver Chief Mining Co.

This company owns the *Dolly Varden* group of eight claims situated near the mouth of Dolly Varden creek, emptying into Chilliwack lake. The group is reached from Chilliwack by wagon-road to Hipkoe's ranch, about 15 miles from Chilliwack. From that point to the outlet of Chilliwack lake is a distance of 30 miles over a fairly good horse-trail. From the outlet of Chilliwack lake to the head of the lake is about 7 miles, and from there to the mine-workings is about half a mile. The group is very close to the International Boundary.

In the vicinity of the *Dolly Varden* group the country-rock is granodiorite, and where the mining-work has been done there occurs a shear-zone apparently about 20 feet in width in the granodiorite in which are found gash-veins filled principally with quartz and with the lines of strike trending towards north-east.

The mineralization is noticeable at a point between the *Dolly Varden No. 1* and *Dolly Varden No. 2* in a shear-zone in which appears to be an upper and lower vein, with about 18 feet of country-rock between, considerably fissured. A third vein extends between the upper and lower veins and apparently forms a connecting-link between them. Two veins, each about 6 inches wide, have been followed by open-cut work for a distance of 55 feet in length.

Samples.—Eight samples were taken during my examination on October 5th last. Sample No. 1 represents the quartz vein in an open-cut drift on the *Dolly Varden No. 1*, which assayed: Gold, 0.04 oz.; silver, 44 oz. to the ton; copper, 1.8 per cent. Sample No. 2, taken in the floor of the same open-cut, assayed: Gold, trace; silver, 8 oz. to the ton; copper, *nil*. Sample No. 3, taken across 8 inches of quartz vein, same open-cut as Nos. 1 and 2 were taken, assayed: Gold, 0.12 oz.; silver, 1 oz. to the ton; copper, *nil*. Sample No. 4, taken across 8 inches of same vein, assayed; Gold, trace; silver, 1.2 oz. to the ton; copper, *nil*. Sample No. 5, across 8 inches of

cross-vein between the upper and lower veins, assayed: Gold, trace; silver, 2.6 oz. to the ton; copper, *nil*. Sample No. 6, from face of a lower open-cut on the *Dolly Varden* No. 2, a vein 5 inches, assayed: Gold, trace; silver, 0.6 oz. to the ton; copper, *nil*. Two other samples were taken from the lower open-cut, both of which assayed: Gold, trace; silver, trace; copper, *nil*.

CHILLIWACK RIVER SECTION

The Chilliwack River section comprises the watershed drained by the tributaries of the Chilliwack river between Vedder Crossing and the outlet from Chilliwack lake, a distance of about 30 miles. The largest of these tributaries are the Tamihi, Slesse, and Nesakwatch creeks, which flow into Chilliwack river from the International Boundary line. The main tributary of the Chilliwack is Ford creek, which has its source in the Cheam range on the *Lucky Four* group.

The most extensive and important prospecting in this section has been done in the mountains along the International Boundary-line. The area in which the most prospecting has been done on the Canadian side of the boundary is around Pierce mountain on Nesakwatch creek, and the prospectors who have been chiefly responsible for making locations in that section own about thirty claims in good standing. Several of these I examined in 1915 and described in the Annual Report for that year. Gold-bearing quartz occurs on several of these claims, but the development-work has not up to the present been followed up.

On the north side of the Chilliwack river prospecting has been confined principally to Ford and Silver creeks. On Ford creek copper sulphide ores carrying small quantities of gold and silver, has been reported, and also on Silver creek are occurrences of galena zinc ores. No serious development-work has yet been done on any of these claims, the owners awaiting the results of development on the *Lucky Four* group.

VANCOUVER MINING DIVISION

The Vancouver Mining Division is the most important from a producing standpoint of any in District No. 6. This is owing to the fact that the *Britannia* mine began shipping in 1923, the shipments forming practically all the metalliferous mineral production in the district.

There was one other producer during 1923 in District No. 6. This was the *Indian* (Alert Bay), Sidney Inlet, Vancouver Island. The product in 1923 of the *Britannia* was 22,158,836 lb. copper, 108,964 oz. silver, and 4,876 oz. gold. The tonnage of the ore broken was 780,820 tons and the tonnage milled was 682,511 tons.

General Geology.—The general geology of the Vancouver Mining Division was examined by O. E. LeRoy in 1906, whose examination extended along the coast line and islands from the International Boundary to the mouth of Powell river on Malaspina strait. LeRoy's report was published in the Geological Survey, No. 968, 1908. LeRoy described the Eocene rocks and igneous rocks cutting them in the vicinity of Vancouver.

During 1919 and 1920 the geology of the Fraser River Delta Map-area was investigated by W. A. Johnson, Geological Survey of Canada, whose report has been recently published as Memoir 135, Geological Survey, and describes the bed-rock geology of this area in detail, but does not describe the geology of the mountains north of Burrard inlet, which from a metal-mining point of view, is the most interesting feature connected with the Vancouver Mining Division.

The mountainous section, especially in the vicinity of the *Britannia* mine, is described in full detail by S. J. Schofield in the Summary Report, Geological Survey, 1918, Part B: "Britannia Map-area." Charles A. Camsell, in Summary Report, 1917, Part B Geological Survey: "Reconnaissance along the Pacific Great Eastern Railway between Squamish and Lillooet" describes the geology along the line of the Pacific Great Eastern.

After reading the recent report by W. A. Johnson on the geology of the Fraser River Delta Map-area (*which see*), I deem it desirable to refer briefly to some portions of that report before giving a description of the recent developments in the *Britannia*.

Mr. Johnson calls attention to the fact that the known geologic history of the Fraser Delta region begins with the intrusion during Upper Jurassic time of the Coast Range batholith. He says: "The rocks into which the batholith was intruded have been largely eroded away, but at the time of the intrusion they must have been of considerable thickness and extent, and probably occupied a broad synclinal basin of deposition. At that time the area of the Coast

mountains was probably converted into a mountainous tract with a general character not unlike that now presented.

"In Lower Cretaceous time parts of the region may have received sedimentary deposits, since Lower Cretaceous marine sediments occur in the valley of the Fraser above Yale, but, if so, they were later eroded.

"In Upper Cretaceous time deposition of marine and continental sediments may have taken place in parts of the area, for Upper Cretaceous sediments (the Nanaimo series) occur on the west side of the strait of Georgia and extend beneath the waters of the strait, but the map-area may have remained elevated and been the source of part of the sediments. Upper Cretaceous period as a whole in this region was one of erosion, in which the mountains produced by folding, which accompanied the intrusion of the Coast Range batholith, were worn down sufficient to expose the granitic rocks, and probably sufficient to produce a general surface of low relief."

I have called attention to the above extracts from Mr. Johnson's report because Burrard inlet is the southern boundary in British Columbia of the Coast Range granodiorite batholith and the "Burrard" formation forms the contact with the batholithic rocks in several places on the north shore of Burrard inlet.

In view of the fact that for some years past diamond-drilling has been carried on in the hope of the discovery of oil in several points in the Fraser delta, it is interesting to note that Mr. Johnson has given the logs of several diamond-drill borings which have penetrated the "Burrard" formation, notably the boring done by the Spartan Oil Company about a mile north-west of Burnaby lake, where the "Burrard" formation was penetrated to a depth of 895 feet, the total depth of the hole being 2,000 feet. He also gives the log of a second diamond-drill hole put down by the Spartan Company, which he states passed through the Kitsilano formation and penetrated the "Burrard" formation to the depth of 2,875 feet from the surface. The logs of several other drill-holes in other parts of the Fraser River delta are published in Johnson's report, but in no case was the drilling followed by any commercial flow of oil. In his concluding remarks relative to oil Mr. Johnson states as follows:—

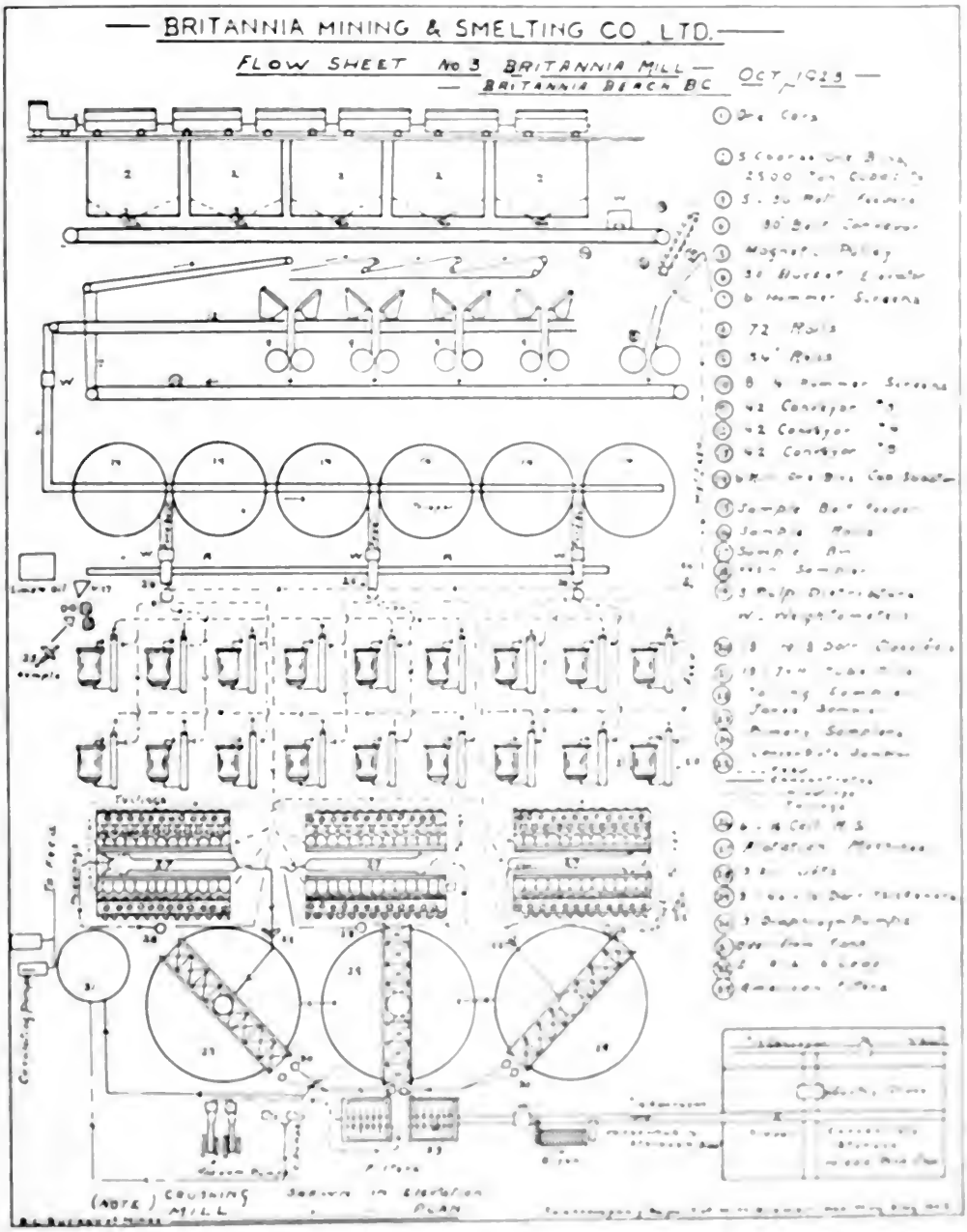
"The answer to the second question, therefore, whether or not the structure of the rocks is favourable for the accumulation of oil or gas into pools of sufficient size to be of commercial importance, is that the general structure of the Tertiary rocks may be not unfavourable, but their internal structure is such that important reservoirs of oil or gas are not likely to occur. It is hopeless to drill for oil in the igneous rocks of the Coast Range batholith; they are not a possible source of oil and are not sufficiently porous to act as reservoir rocks. It is not definitely known whether older sedimentary rocks underlie the Tertiary rocks in places in the area, but, even if they do, they are probably beyond the reach of the drill. It must be concluded, therefore, that the prospects of obtaining commercial supplies of oil or gas in the Fraser Delta area are not very bright."

Britannia Mining and Smelting Co.

After having been a non-producer during 1922 owing to the efforts of the company being centred in rebuilding the concentrating-mill which was burnt down in 1921 and in perfecting the underground connections between the main haulage-adit on the 4,100-foot level and the mine-workings on the 2,700-foot level by means of an upraise 1,465 feet high on a 65° incline, also in rebuilding the town at Britannia Beach, most of which was swept away by the flood and slide in October, 1921, and in underground development-work in the *Victoria* and *Empress* of the *Britannia* workings, and building the camp on the *Victoria*, it is gratifying to be able to record that during 1923 the *Britannia* again became a producer, having to its credit the production of 22,158,893 lb. copper, 108,964 oz. silver, and 4,874 oz. gold, which was produced from 682,511 tons of ore milled; while during 1923 790,629 tons of ore was broken in the mine. Briefly, the following is the record for 1923:—

On February 4th, 1923, the new mill was started and the first ore milled. During that month 6,000 tons of ore was milled, which tonnage was rapidly increased until on August 28th the record for one day's operations in the mill was reached, when 3,002 tons of ore was treated, and during August and September the average daily tonnage exceeded 2,700 tons. When it is considered that the mill was designed for a daily capacity of 2,500 tons, the fact that during August and September the tonnage treated daily exceeded 2,700 tons speaks volumes as regards the operating practice. The flow-sheet of the new mill, known as the No. 3 *Britannia* mill, is shown in detail in the accompanying plan.

At the general meeting of the British Columbia Division of the Canadian Institute of Mining and Metallurgy, A. C. Munro, superintendent of the *Britannia* [illegible] detail the milling practice at the *Britannia*. Briefly summarized, this paper [illegible] the character of the ore; then proceeds to describe the coarse crushing [illegible]



crushing plant at the mill; the washing plant in connection with the crushing plant at the mill; the rolls in the crushing plant in the mill; the arrangement of the mill below the crushing plant, fine grinding mills, the flotation, handling of concentrates, and [illegible] which are used in transporting the concentrates to the [illegible].

Mr. Munro, after stating that the cost of bunkering and loading the *Britannia* concentrates in former years was 26 cents a ton, whereas it is now under 4 cents a ton, devotes the following paragraph to operating results:—

"The costs of coarse crushing, secondary crushing, final grinding, and flotation, as stated, total approximately 38 cents. The cost of miscellaneous items, including general expense, 'Workmen's Compensation Act,' and excluding Mineral Separation royalty, is 15 cents, which makes a total direct milling-cost about 50 cents a ton of ore treated. A reduction of 21 cents a ton of ore treated has been made in milling-costs since the first month of normal operations. Our mill-running time for the past five months has been over 99 per cent. The percentage of copper-recovery is over 93. While we are justly proud of these results, we are not satisfied if there is room for an even higher recovery and a further reduction in milling-costs. We realize that in the copper industry it is to be 'the survival of the fittest' and we do not intend to be one of those that 'take the count.'"

Further particulars with regard to the milling practice at the No. 3 *Britannia* mill, as obtained from the general manager, are as follows: When the new No. 3 *Britannia* mill was first started the concentration based on 11 to 1 resulted in producing concentrates carrying 10 per cent. copper, but since September last, because of the improved methods, the concentrates have been carrying as high as 22 per cent. copper, the concentration being in the same proportion. The copper content in the heads of the feed has been averaging 1.9 per cent., in addition to which there are low gold and silver values.

Geology.—It is hardly necessary to refer to the geology of the mineralized zone known as the "Britannia belt" or to the location of the Britannia Company's property because descriptions have been published in every annual report since 1911, to which are referred those who have not already seen them. I will, then, state briefly as follows:—

The mineralized zone known as the "Britannia belt" extends in an easterly direction from Britannia Beach to the Indian river, the distance being about 12 miles. The property owned by the Britannia Mining and Smelting Company embraces about 500 mineral claims covering an area of approximately 25,000 acres in a solid block, extending from Britannia Beach to the Indian river. In the Summary Report, Geological Survey, Canada, 1918, Part B, S. J. Schofield describes the "Britannia Map-area," copies of which can be obtained from Geological Survey.

Mining Practice and Development.—During 1923 the mining practice at the *Britannia* has been as follows: The ore sent to the mill has been extracted from the *Fairview*, *Bluff*, and *Victoria*. Four-fifths of the total ore mined has been taken from the *Fairview* and *Bluff*, while one-fifth was mined from the *Victoria*. No ore was transported from the *Empress*. The glory-holes on the *Bluff* and *Fairview* were operated from June 1st to November 15th. The year 1923 was the seventh season for operating the *Bluff* glory-hole and the first season for operating the *Fairview* glory-hole. On October 1st the supply of ore that had been going to the mill from the *Bluff* was cut off on account of the low price of copper.

The development-work done in the *Britannia* during 1923 may be summarized as follows: Total driving, working-openings, including raises, drifts, crosscuts, and shaft-work, 6,700 feet. Of this, 3,800 feet was breaking ore and 2,900 feet development-work outside of ore-bodies. Out of the total 6,700 feet, 4,500 feet was done on the *Victoria*, the balance on the older sections known as the *Empress*, *Fairview*, and *Bluff*.

During 1923 diamond-drilling totalling 11,945 feet was done in the *Britannia*, 7,259 feet were drilled in the older sections of the mine, and 4,686 feet drilled for prospecting in new territory east of the *Victoria*.

Some of the important development-work done during 1923 was extending the main haulage-adit on the 2,200-foot level from the *Fairview* towards the *Victoria;* also driving on the same level from the *Victoria* to meet the driving from the *Fairview*, and thus to make a connection in order to facilitate transportation of ore from the *Victoria* to the haulage-adit on the 2,200-foot level. There has been 4,300 feet driven in this work and there still remains a distance of 4,500 feet to be driven in order to make the connection mentioned.

This new system of haulage will necessitate a transfer-station at a point about 4,500 feet from the *Victoria* workings in order to transfer ore from the ordinary mine-cars to the large cars used for hauling ore from the ore-bins near the face of the 2,200-foot level adit and on the electric railway. It will also be necessary to install a crushing plant at the *Victoria* workings, as under the present system the crushing plants in the mine are on the 1,700-foot level and 1,800-

foot level in the *Fairview*, and under the proposed haulage system the ore from the Victoria will be delivered on the 2,200-foot level instead of on the 1,900-foot level as at present.

The present system of transporting the ore is by electric trains through the 2,200-foot level adit and in the open over the narrow-gauge railway from the portal of that adit to the 2,700-foot level, where the ore is delivered at the top of the rock-raise which connects the 2,700-foot level with the 4,100-foot level, or about 1,465 feet below the 2,700-foot level at an incline of 65°, where the ore is delivered into large cars hauled by electric motors a distance of about 4,000 feet to the portal of this adit, on one floor-level, above the ore-line at the top of the mill.

When the erection of the new No. 3 Britannia mill was planned with its increased capacity over the No. 2 mill, the question of extra power necessary to drive all the machinery in the mill and mine, as well as for haulage and lights, became such an important consideration that a contract was made with the British Columbia Electric Railway Company to transmit 6000 horse-power from North Vancouver to the *Britannia* via a power-line constructed along the shore.

This power-line is 30 miles long and was completed in December, 1923, so that in future there will be no necessity to employ a steam plant intermittently as a subsidiary to the water-power plant. During the summer of 1923 there was such a drought that the company's steam plant had to be kept in operation intermittently from August 10th until the completion of the new power-line.

During 1923 Dr. S. J. Schofield made a private geological examination for the Britannia Mining and Smelting Company, Limited, of the mineral claims owned by the Britannia Company in the Indian River section. Before the field-work of the examination was finished Dr. Schofield had to sail to Hong Kong; consequently no information relative to his report has been made public, nor can it be obtained, except through the courtesy of the company.

In connection with Dr. Schofield's work on the Britannia Mine area, I desire to correct a statement made in my report for 1922 relative to the early prospecting of the Victoria section of the *Britannia* mineral-zone, to the effect that the earliest prospecting on the Victoria was based on the advice of Dr. Schofield, as follows: "He advised that such prospecting ought to result in exposing an ore-body in that section." This should have read: "That early in 1918 it was the opinion of I. W. D. Moodie, the general manager for the company from 1911 to 1920, that an easterly extension of the mineral zone in the *Empress* would be found in the Victoria, although there were no surface indications, and he had ordered that the prospecting be done." This work was under way in this section when Dr. Schofield was making his examination. After the prospecting-work had been ordered by Mr. Moodie, Dr. Schofield, after making a detailed geological survey, confirmed this opinion. The discovery of the enormous ore-body that has since developed in the *Victoria* has fully borne this out.

I make this correction with pleasure from information recently received from C. P. Browning, the present general manager of the Britannia Mining and Smelting Company, because, while Mr. Moodie's record as a mining engineer has been so successful for many years that complimentary remarks are superfluous, yet it is a fact that the discovery of such an extensive and important ore-body as is being developed in the Victoria under the circumstances which it was discovered—that is, lack of surface indications—adds such a lustre to the reputation of any mine manager that it should be carefully recorded in Government and other reports.

PACIFIC GREAT EASTERN RAILWAY SECTION

The country tributary to the Pacific Great Eastern Railway between Squamish, at the head of Howe sound, and the divide between Alta and Green lakes, about 40 miles north of Squamish, is included in the Vancouver Mining Division, and although there has not yet been developed a producing mine in this section, still there are several prospects with promising possibilities on which annual assessment-work has been done for some years past. Several of these are in the vicinity of Ray creek, a tributary of the Stawamus river which flows into the head of Howe sound a short distance southerly from Squamish; others are at the extreme head of Indian river, about 12 miles south-easterly from Squamish.

The claims, which include the *Bruce*, *Contact*, and *Radical* groups on Ray creek and the *Bell* and *Bulliondale* groups at the head of Indian river, have been described in several of the annual reports since 1917, and as there were no important developments made during 1923 it is not necessary to repeat previous descriptions.

J. H. McVicker and J. W. Brown, of Britannia Beach, prospected in the vicinity of Goat creek, a tributary of the Mamquam river, about 9 miles easterly from Squamish, where they staked in August last the *Sunshine* group, containing the *Sunshine Nos. 1, 2, 3,* and *4;* also the *Rainstorm, Noonday,* and *Hardy.* These prospectors reported that they discovered chalcopyrite and pyrite ores in a schist-zone apparently similar to the *Britannia* schist, but the discoveries were reported to me too late in the fall to make an examination.

A limited tonnage of limonite-iron ore was shipped from the deposits on the *Iron King* group near Alta lake, controlled by Dr. Davidson and J. H. Thompson, of Vancouver.

Assessment-work during 1923 was done on several claims in the vicinity of Brew, on the Pacific Great Eastern Railway, also near Cheakamus lake, the source of the Cheakamus river in the mountains about 12 miles southerly from Alta lake.

Jervis Inlet Section.

R. D. Watson and Phillip White, of Vancouver, and other prospectors were engaged during a considerable part of the season of 1923 in prospecting in the vicinity of Mount Diadem and Red Mountain, between the head of Hotham sound and Britain river, in the vicinity of the *Lillie-Grovan* group. They were also engaged in cruising a route for a new trail into that part of the Jervis Inlet section.

The Baramba Mining Company, owning a group of mineral claims near the head of Hotham sound, did the necessary assessment-work during 1923 in order to keep ten of the claims in the group in good standing.

On the group of claims on the Tzoonie river, at the head of Narrows arm, Seechelt inlet, the necessary assessment-work was done to keep them in good standing. This group is represented by Peter J. Sanson, of Pender Harbour.

Nelson Island Section.

Nelson island, situated at the entrance to Jervis inlet, has been coming into prominence the last few years because of the superior quality of granite that is being quarried by the Vancouver Granite Company, Limited, 543 Granville Street, Vancouver.

The demand for this granite is shown by the fact that the total output from the quarry during 1923 will approximate 96,000 cubic feet. This product has been distributed as follows: To the Dominion Government Dry-dock at Esquimalt, 43,515 cubic feet; to the new buildings of the University of British Columbia at Point Grey, 10,367 cubic feet; to the monumental trade, 21,011 cubic feet; and in addition to the above there has been marketed about 1,200 cubic yards of rubble.

In connection with this production it is interesting to note that the major portion of the rock sold to the monumental trade was exported to the United States, and in view of the fact that under the Fordney tariff the United States import duty was increased five times, or from 3 to 15 cents, speaks well for the quality of the Nelson Island granite.

VICTORIA MINING DIVISION.

The Victoria Mining Division includes all of the south-easterly end of Vancouver island—roughly, south of Cowichan lake—and the small islands in the strait of Georgia adjacent to that end of Vancouver island.

During 1923 the metal-mining industry in the Victoria Mining Division has not been as active as I would like to have been able to record. There are several reasons to account for the apparent lack of progress, the chief being the unsatisfactory condition of the copper market during the past year, while another reason has been the fact that the Esquimalt & Nanaimo Railway land-grant includes all of the Victoria Mining Division, and no arrangements have yet been perfected between the Government and the Esquimalt & Nanaimo Railway Company by which the present dual control with regard to titles can be abolished. This latter has been one of the principal causes for discouraging prospectors and operators.

Bauxite.

The discovery of bauxite was made in the spring of 1923 when samples were taken from outcroppings of limonite- or bog-iron ore that occur on Demaniel and Stony creeks, near Sooke. This deposit was first described by C. H. Clapp in Memoir 96, "Sooke and Duncan Map-areas,

Vancouver Island," Department of Mines, Canada, Geological Survey, on page 292 as follows:

"In the Sooke district, in the vicinity of Demaniel creek, is a bed or lake deposit of yellow ochreous clay which has been mentioned as a source of iron ore. Since the material contains only 15.5 per cent. iron, it is of too low grade for iron ore; it is however suitable for cheap paint and the deposit is described more fully under 'Pigments.'"

The deposit was also described in the Annual Reports for 1922 and 1921. The examinations on which these reports were based were made chiefly with a view of determining whether the limonite- or bog-iron ore carried sufficient metallic iron to be of commercial value in the manufacture of pig-iron.

During the spring of 1923, in a conversation with Dr. Victor Dolmage, of the Geological Survey, Canada, on his return from Ottawa, he informed me that some samples he had taken from the Demaniel Creek deposit in the fall of 1922 were causing considerable interest in the Mines Department at Ottawa owing to the fact that analysis showed that the material was the nearest approach to bauxite that had been so far discovered in Canada.

As a result of this conversation I made another examination of the deposits in 1923, when I took four samples, two from Stony creek and two from Demaniel creek, which were assayed by D. E. Whittaker, Assistant Provincial Assayer, with a view of determining whether or not the material could be considered bauxite. The samples analysed as follows:

Analysis made on the Solubility in Sulphuric Acid

Sample.	Loss on Ignition	Insol.	Al_2O_3	Fe_2O_3	CaO	MgO	Ti
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		
No. 1, Stony creek, Sooke	12.3	25.0	29.5	30.5	0.4	Nil	Nil
No. 2, Stony creek, Sooke	13.4	30.7	30.0	22.0	0.4	Nil	Trace
No. 3, Demaniel creek, Sooke	10.2	62.2	19.0	6.0	2.5	Nil	Nil
No. 4, Demaniel creek, Sooke	16.0	35.0	29.0	16.0	1.3	Nil	Trace

These analyses show that the material in these deposits is the nearest approach to the mineral bauxite that I know of in the Province, but the analyses also show that when compared with the bauxite of commerce, which is used in the United States at present for manufacture of aluminium, the material is much lower in Al_2O_3, also higher in insolubles.

For instance, the following table of analyses of bauxite is taken from the *Engineering & Mining Journal-Press* of May 5th, 1923, from an article by J. M. Hill, Geologist of the United States Survey, entitled "The Marketing of Bauxite." This table is given in order to show the comparison between the bauxite of commerce and the samples taken from Stony and Demaniel creeks.

"*Grades of Bauxite.*

"The following table, IV., gives analyses of typical foreign and domestic bauxites. Arkansas bauxite is considered the best domestic material and is practically the only bauxite used in the aluminium industry. Georgia bauxite finds its principal market with the chemical industry. The abrasive industry draws from both the Arkansas and Eastern fields, the material suited for this industry being sorted in mining.

"*Table IV.—Analyses of Bauxite.*

Location.	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	Water at 100°
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Alabama	7.00	56.00	2.75	2.50	27.50
Arkansas	10.64	57.48	2.56	1.25	28.56
Georgia	14.47	54.57	1.93	1.61	26.93
Georgia	8.84	58.28	1.50	1.80	29.58
Georgia	10.63	57.91	0.91	1.44	29.70
Tennessee	18.38	40.90	4.13		27.59
Tennessee	17.16	53.34	2.10	Omitted	Omitted
French bauxite	2.80	57.00	25.20	3.1	10.80

"For the preparation of alumina low enough in silica to make aluminium it was formerly believed necessary to have bauxite carrying over 52 per cent. alumina (Al_2O_3) and less than 3 per cent. silica (SiO_2). Now, however, it is understood that bauxite carrying less than 50 per cent. Al_2O_3 and from 3 to 7 per cent. silica is being used successfully in the United States."

In referring to the uses for which bauxite is adaptable, Mr. Hill states as follows:—

"*Bauxite.*—Bauxite is the ore of aluminium, the crude material for the manufacture of artificial aluminium abrasives, such as alundum; the chief crude material for the manufacture of various aluminium salts, such as alum, aluminium chloride, and aluminium sulphate; and is used to some extent in the manufacture of aluminium refractories, which are sold as bauxite brick or high-alumina brick.

"For the aluminium industry bauxite must be first treated in a chemical plant for the preparation of practically pure alumina, and for the manufacture of aluminium chemicals the bauxite is first chemically treated. For the manufacture of abrasives and refractories the material is used without preliminary treatment other than drying and fine grinding for mixing with other ceramic material for refractory purposes."

Since the article above referred to was published shipments of the Demaniel Creek bauxite have been made to the local gasworks, where it has been used for purifying gas, and, I am reliably informed, has given good satisfaction. I have also ascertained that bauxite is now being used in oil-refineries, a use which I understand is growing rapidly.

In connection with the Demaniel and Stony Creeks deposits, it is interesting to note that quite recently I have received inquiries and requests for samples from the metallurgist of the Granby Consolidated Mining, Smelting, and Power Company, also from the British Columbia Cement Company, Limited, asking for full particulars relative to the deposit and the material.

It is not necessary in this report to repeat the descriptions of the deposits, as such were published in the Mines Report for 1921, also for 1922.

I have given this subject considerable attention, because I consider that the finding of this material, and, what is more important, a market for it should be widely published in order to encourage prospectors to search for minerals other than gold, silver, and copper.

Of course, the argument may be used that the discovery is not of great importance because the ore is of such low grade when compared with other deposits, but it is well for prospectors to remember that, while the deposits on Stony Creek and Demaniel creek have been known to a few people and recognized as bodies of bog-iron ore for the past twenty-five years, they have been lying idle during that time for lack of a market, caused to a great extent by the fact that the occurrences were not given general publicity.

It is also well to remember that in the various occurrences of bauxite ore in the United States and France the analyses of samples and shipments vary very widely; consequently, for the purpose of the manufacture of aluminium, a very close check has to be kept on sampling and analysing each wagon-load, because of the wide variations in the contents of the ore, as to alumina and silica, not only in the same deposit, but within a few feet in the quarry or pit.

The following clipping from a late issue of the *Journal of the Society of Chemistry and Industry* is interesting as pointing to a market in connection with the working of the Demaniel and Stony Creek deposits. In a detailed description of the Llandarcy Refinery of the Anglo-Persian Oil Company of South Wales is the following:—

"The kerosene fraction receives its final treatment by means of filtration through granulated bauxite, a reddish-brown aluminium ore. The bauxite, previously roasted, removes sulphur and colour, the oil coming from this process sweet in odour and perfectly colourless, being in fact the highest grade of lamp-oil or kerosene. After a certain period of use the bauxite is reroasted to burn out the impurities taken from the oil, after which it can be used again. In the extraction of paraffin-wax bauxite is also used, the wax undergoing a final treatment of filtration through bauxite to remove the colour."

TALC.

Eagle Talc and Mining Co.

This company, under the management of W. G. Dickenson, has been operating practically continuously during 1923 in mining and preparing talc from the company's deposit on Wolf creek, a tributary of the Sooke river which empties into that river near Old Leechtown. During 1923 the production from this property has been approximately 250 tons. The talc is prepared in the Forrester mill into three grades; the finest or about 8 per cent. of the total product is crushed to 200-mesh; a portion

of the remainder is crushed to a fineness of 150-mesh; while the greater proportion of the talc rock mined is crushed coarser than the 150-mesh. The finest-crushed material is used in paint factories, the second grade is used in paper mills, and the coarser material is used by the Sidney Roofing and Paper Company, Limited, of Victoria, for dressing roofing material and preventing the folds from sticking together when the roofing sheets are rolled up.

The development-work in the mine has been extended during 1923 by driving the No. 1 (or main) adit to a length of 120 feet, or 60 feet longer than when I examined the property in the late fall of 1922; also by driving a No. 2 adit a distance of 20 feet on the same level as the No. 1, but with its portal 20 feet northerly from the No. 1 adit. The No. 2 adit is developing a second deposit of talc which is separated from that exposed in the No. 1 adit by a narrow belt of blackish slate, very much crushed and contorted.

In the face of the No. 1 adit there is an undetermined width of talc of very good commercial grade. The width exposed is fully 5 feet, which is the full width of the face, but the talc appears to have a greater width extending beyond the walls of the adit. In the face of the No. 2 adit the talc is about 2½ feet wide, where the body of talc occurs in a V shape with the talc of commercial grade on each side of the V, but with slate in the wide part of the wedge and talc below the point of the wedge.

The strike of the talc exposed in the No. 1 adit is nearly west (mag.), while the strike of the body of talc in the No. 2 adit is nearly parallel to that of the talc in the No. 1, but in the face of the No. 2 adit the strike appears to be trending towards the main body, and if a junction is formed between the two bodies, then the width of talc of commercial grade would be very considerably increased.

The face of the No. 1 adit is 75 feet vertically below the surface, but the face of the No. 2 adit has not yet reached the point where the backs are so great.

Great care has to be exercised in mining, as the talc rock is fairly well saturated with water and will slough or cave down unless very carefully and closely timbered.

JORDAN RIVER SECTION.

The Jordan River section of the Victoria Mining Division has been for the past few years the most interesting section of that Division, due to the fact that the groups of mineral claims staked on both sides of the Jordan river, about 2 miles above its mouth, possess potential commercial value, greater at the present time than any other groups in the Division, and because systematic development-work has demonstrated that the ore bodies that occur in the gabbro and Metchosin volcanic rocks are persistent and deep-seated.

While it is perfectly true that on the Sooke peninsula, about 20 miles easterly from Jordan river, where outcroppings of copper-sulphide ores occur in rocks similar to those in the Jordan River section, there has been considerable development work done on the *Margaret* and *Willow Grouse* groups, yet it is also a fact that no prospecting or development has been attempted in that section of a sufficiently extensive or comprehensive character to warrant a decided opinion being expressed as to the potential commercial value of these groups. The work in the Sooke section as compared with the extent of the work that has been done on the *Sunloch* and *Gabbro* groups in the Jordan river section is so much less in extent and thoroughness that that fact should encourage those seeking investments to thoroughly and systematically prospect, especially in this section of Vancouver Island, not only the older mineral claims that have been prospected, but every indication of the occurrence of sulphide ores associated with similar geologic conditions.

Gabbro Copper Mines, Ltd.

This company owns the *Gabbro* group of twenty-three mineral claims which adjoins the *Sunloch* group on the south-west and is located about 2 miles above the mouth of Jordan river. The mineral claims which comprise the *Gabbro* group are located *en bloc* and the boundaries extend from the east to the west side of Jordan river, which flows through a deep canyon and divides the *Gabbro* group into two sections in a somewhat similar manner as the river divides the *Sunloch* group into two sections, with this difference: that while a greater proportion of the development work on the *Gabbro* group has been done on the westerly side of the river, most of the development work on the *Sunloch* group has been done on the easterly side. The dividing line between the *Gabbro* and *Sunloch* claims is somewhat irregular, but trends in a general way in a north-westerly direction, leaving the claims contained in the *Gabbro* group on the westerly side of the boundary-line and the *Sunloch* group on the easterly side.

In the Annual Report for 1922 I described the occurrences of copper ore and the work done by the Gabbro Copper Mines, Limited, in considerable detail. In this present report I am confining my description to the results shown from extending the prospecting-work that had been previously done.

My last examination of the work was made in November, 1923, and was confined to that portion of the Caulfield mineral-zone which outcrops on the *Black Hornet* in the steep bank of the Jordan river, and the prospecting-work that has been done by making a series of open-cuts and trenching along the strike of the Caulfield zone in a north-westerly direction as far as to the banks of Sinn Fein creek, a distance of about 500 feet. In this distance there have been six open-cuts made, in which copper-sulphide ores are exposed occurring in a shear-zone in basaltic rock. The shearing is very pronounced and the series of prospect-holes indicates very strongly that the mineralized zone is continuous across the southerly portion of the *Black Hornet*.

Samples and Assays.—Several samples were taken from the various open-cuts mentioned which were assayed in the Government Laboratory, Victoria, and showed the following results:—

No. 1 grab sample from open-cut from bank of Sinn Fein creek on the *Black Hornet*, about 500 feet north-westerly from the open-cut in the river-bank on the same claim. Sample taken from several stringers of ore across 20 feet in a shear-zone assayed: Gold, 0.04 oz.; silver, 0.6 oz. to the ton; copper, 6.2 per cent.

No. 2 sample from a prospect-hole about 100 feet easterly from No. 1 sample assayed: Gold, trace; silver, trace to the ton; copper, 1 per cent.

No. 3 sample from prospect-hole about 100 feet south-easterly from No. 2 open-cut in the sheared zone 17 feet wide, taken from solid ore 15 inches wide, assayed: Gold, *nil;* silver, *nil;* copper, 4.8 per cent.

Samples Nos. 4, 5, and 6 from open-cut at the lowest point in the westerly bank of Jordan river, where prospecting has been done on the Caulfield mineral-zone, which is fully 20 feet wide, represent the general conditions but do not represent a strict average.

No. 4 sample assayed: Gold, trace; silver, 0.6 oz. to the ton; copper, 5.1 per cent. No. 5 sample assayed: Gold, *nil;* silver, *nil;* copper, 1.3 per cent. No. 6 sample assayed: Gold, trace; silver, 0.4 oz. to the ton; copper, 2.1 per cent.

The prospecting-work done so far on the *Gabbro* group has been thorough and systematic; consequently has resulted in showing such exposures of ore occurrences in the various shear-zones as to enable an examining engineer to form a very close estimate as to the results that may be expected from further prospecting and underground development-work.

The *Gabbro* group apparently has potential values far beyond the average prospect and promises that when properly developed it should make one of the really good mines in the district.

Canadian National Railway Section.

The transportation facilities in that section of the Victoria Mining Division which includes the Sooke peninsula, Shawnigan and Cowichan lakes, and the Koksilah river have been very materially improved by the completion of the Canadian National Railway from Victoria to Cowichan Lake. In future that portion of the Division now served by the railway should certainly prove a more attractive field for the prospector.

Travelling northerly past Sooke and Shawnigan lakes the Koksilah River section is reached. This is traversed by the Canadian National Railway and several claims from which shipments of copper-sulphide ores were made about twenty years ago are so situated that their product can now be hauled over the railway, which passes close by the workings on some of them.

The most prominent claims in the Koksilah River section are the *King Solomon* and *Blue Bells* groups. They were developed to a considerable extent about twenty years ago and several hundred tons of ore was shipped from them. The product from the *King Solomon* was shipped to the Crofton smelter and that from the *Blue Bells* to the Ladysmith smelter, but operations were abandoned because of the prohibitive cost of transportation, which included a wagon-haul of about 5 miles to Cowichan Station, on the Esquimalt & Nanaimo Railway, in addition to the railway-haul from Cowichan Station to either of the smelters mentioned, but now the grade of the Canadian National Railway is close to the portal of the lower adit on the *King Solomon*, which was driven in 1913. The *Blue Bells* would require a short aerial tramway to connect the mine-workings with the railway.

Owing to improved transportation facilities I examined these groups of mineral claims during the past summer, but found that the workings would have to be cleared out and the shafts, of which there are four on the two groups, unwatered before any data sufficient to base a report on could be obtained.

The prevailing country-rock in this section belongs to the "Vancouver group" as classified by Clapp and other geologists.

The *King Solomon* and *Blue Bells* groups adjoin, the workings on the *Blue Bells* being situated in a general north-westerly direction from the *King Solomon* workings.

There are apparently two distinct and well-defined lenses of ore occurring, one on the *King Solomon* and another on the *Blue Bells*. These ore-bodies belong to the contact metamorphic type of ore-bodies, although the ore does not occur exactly at the contact, but at some little distance from it. The ore is associated with such metamorphosed minerals as garnet, epidote, and diopside.

Clapp in his report on the "Sooke and Duncan Map-areas, Vancouver Island," Memoir 96, Geological Survey, Canada, draws attention to the fact that, although not in contact with the mineral-deposit, there are several small stocks of Saanich granodiorite in the vicinity of the *King Solomon*, and that in contact with the ore-body is a dyke-like mass of quartz bearing feldspathic gabbro which is apparently closely related to the Saanich granodiorite.

The metallic minerals found in the ore-deposits on the *King Solomon* and *Blue Bells* groups are pyrrhotite, pyrite, and chalcopyrite. The ore-deposits on both the *King Solomon* and *Blue Bells* show a maximum width of nearly 50 feet, about one-half of which shows a richer mineralization than the remainder. The length of these ore-deposits has not been determined in either of the groups, but apparently the length of each lens exceeds 200 feet.

The values as shown from smelter returns indicate that the ore-bodies have an average exceeding 2 per cent. copper, associated with which are low gold and silver values.

CHEMAINUS RIVER SECTION.

The area comprised in the Chemainus River section is situated south westerly from the town of Ladysmith and near the headwaters of the Chemainus river, and includes a section of the mountainous country within the boundaries of the Esquimalt & Nanaimo Railway land grant, most of which area is covered by timber holdings owned by the Victoria Lumber and Manufacturing Company, of Chemainus.

Transportation Facilities.—At present the transportation facilities of this section are very limited, but the Victoria Lumber and Manufacturing Company is constructing a logging railway up the river which will eventually afford transportation facilities and obviate the necessity of travelling over the trail from Ladysmith. The logging-railway is at present completed as far up the Chemainus river as Copper canyon, between Mount Sicker and Mount Brenton, about 9 miles westerly from Chemainus village.

Red Cliff Group. This group contains the *Red Jacket*, *Red Cliff*, and *Blue Grouse*, owned by Charles Cathey and Mrs. Mary Cathey, of Chemainus, and R. Nichols, of Ladysmith. The property is situated about 18 miles via the old Sutton trail from Ladysmith. The claims were located some years ago, when considerable prospecting was done and an adit which crosscut the formation was driven into the mountain in a north-easterly direction 462 feet. No ore of commercial value at that time was crosscut, so work was abandoned in 1902 and has only been resumed since the Victoria Lumber and Manufacturing Company decided to extend the logging railway to the vicinity of these claims.

Geology.—The geologic formations in the immediate vicinity of the *Red Cliff* group have not yet been reported on in detail by any member of the Geological Survey, Canada. The section is a short distance westerly from the western boundary of the Duncan sheet of the "Sooke and Duncan Map-areas," described in Memoir 96, Geological Survey, by C. H. Clapp. The prevailing country-rocks belong to the "Sicker" series of metamorphosed sediments, including tuff, cherty tuff, and black graphitic slate, with schistose structure, and sometimes intruded by igneous dykes. It was the similarity of the rocks in the vicinity of the *Red Cliff* group to the rocks on Mount Sicker in the vicinity of the *Tyee* and *Lenora* that induced the first staking in this section.

Ore-deposits.—Included in this belt of rocks of the "Sicker" series is a belt of jasperized siliceous rock with schistosity which is mineralized with seams of magnetite, some chalcopyrite,

pyrrhotite, and pyrite. Samples from outcrops at various points assayed as follows: (1.) Gold, trace; silver, 0.6 oz. to the ton; copper, 2 per cent. (2.) Gold, trace, silver, 0.4 oz. to the ton; copper, *nil*. (3.) Gold, trace; silver, trace to the ton; copper, *nil*. (4.) Gold, trace; silver, 0.4 oz. to the ton; copper, 1.2 per cent.; iron, 15 per cent.; manganese, trace.

During the spring and summer of 1923 the owners of the *Red Cliff* group have been prospecting the mineralized belt of jasperized schist by making several open-cuts or trenches, which were sampled during an examination in July. The samples taken from a deep open-cut near the discovery post on the *Red Cliff* assayed: Gold, trace; silver, 0.4 oz. to the ton; copper, 2.4 per cent. Another sample from the same open-cut assayed: Gold, trace; silver, 0.6 oz. to the ton; copper, 3.2 per cent.

Apparently this belt of jasperized rock, which has schistose structure and appears to be very similar to some of the "Sicker" schist, is about 40 feet wide and can be followed across three claims, showing some mineralization in several places along the outcroppings. There had not been sufficient systematic prospecting done at the time of examination to warrant an estimate as to the commercial value of the property.

Mount Brenton and Mount Sicker Sections.

For several years past but little attention has been attracted towards Mount Sicker and Mount Brenton sections. To a great extent the reason for this has been the lack of transportation facilities, but with the completion of the logging-railway previously mentioned this section is now receiving more attention, especially on the Mount Brenton side across the canyon from the old *Lenora* and *Tyee*, and during the past summer the owners of claims have been doing the assessment-work more systematically than usual owing to the fact that work has demonstrated that on Mount Brenton practically the same conditions with regard to mineralization occur as was found in the mine-workings of the *Tyee* and *Lenora*.

In Clapp's report on "Southern Vancouver Island" in Memoir 13, Geological Survey, Canada, he describes in great detail the rocks of the "Sicker" series of the Vancouver group, in which occurs on Mount Sicker the extensive lens of copper sulphide which made up the *Lenora*, *Tyee*, and *Richard the Third*, but does not include the ore-bodies on Mount Brenton in his detailed descriptions.

Pauper.

At an altitude of about 2,000 feet up the easterly slope of Mount Brenton the *Pauper*, owned by Mrs. Fry, of Chemainus, is located, while westerly from and adjoining this is the *Whale*, owned by Pearce & O'Rooke, of Duncan. The *Pauper* was bonded in 1919 to E. J. Palmer, of Chemainus, and Louis Levensaler, of Seattle, and under that bond development-work was done consisting of a drift-adit 50 feet long, with a crosscut, also 50 feet long, northerly from the face of the adit. After this work was completed the bond was allowed to expire, notwithstanding that in an open-cut on an outcrop about 60 feet wide a general sample of the ore taken at the time of my examination assayed: Gold, trace; silver, 1 oz. to the ton; copper, 7.5 per cent. This outcropping and open-cut is about 20 or 30 feet higher than the adit referred to. An average sample across 60 feet of outcropping assayed 2 per cent. copper.

This outcropping occurs in the "Sicker" schist in a shear-zone which is very heavily iron-stained. Apparently no ore of commercial grade was exposed in the drift-adit. The adit could not be examined owing to a rock-slide across the portal. As the crosscut from the end of the adit was driven to the north, while the outcropping sampled lies to the south, it is impossible for the crosscut to expose such ore.

Apparently similar conditions with regard to geologic formations and occurrences of ore-bodies occur on Mount Brenton as were found on Mount Sicker. The ore-deposits which carried commercial value on Mount Sicker were proven to only maintain continuity with depth to a given point, below which, although the country-rock was similar, notably the "Sicker" schist and black graphitic slate were found to maintain continuity, they were barren of values.

The summit of Mount Brenton is about 1,100 feet higher, but no work has been done at an higher altitude than the adit referred to. A sample was taken from an outcrop about 300 feet southerly from the drift-adit; this assayed: Gold, trace; silver, 0.2 oz. to the ton; copper, 8 per cent.; and apparently the outcropping represents a parallel lens to that where the drift-adit has been driven.

Whale. This claim adjoins the *Pauper* to the west and extends [illegible] the summit of Mount Brenton. The country rock on the Whale is similar to that on the *Pauper*; apparently there is a continuation [illegible] schist through both claims. Prospecting work only has been done and there appears [illegible] ore-bodies under very similar conditions to the outcroppings on Mount Sicker [illegible] the "Sicker" schist, mineralized with pyrrhotite, chalcopyrite, and pyrite as was [illegible] Mount Sicker.

Water Power and Brenton. At a lower elevation and north-easterly from the *Pauper* are situated the *Water Power* and *Brenton*, owned by Pearce & O'Brien, of Duncan. The former is the lower and adjoins the latter on the eastern side. A creek carrying considerable water known as Hollyoke creek, flows through both the *Water Power* and *Brenton*. This creek could be developed for power for mining and milling operations. Some prospecting-work has been done on both the *Water Power* and *Brenton* but not of sufficient extent to enable a very reliable estimate to be made with regard to the commercial value of the claims.

A selected sample from an outcropping on the *Water Power* assayed: Gold, trace; silver, 3 oz. to the ton; copper, 20.5 per cent. Another selected sample taken from an outcropping on the *Brenton* assayed: Gold, trace; silver, 1.2 oz. to the ton; copper, 5 per cent.

The grade for the Victoria Lumber and Manufacturing Company's railway crosses a portion of these claims.

IRON AND STEEL INDUSTRY.

In the introduction to my report I mentioned under the heading of "Iron and steel industry" that K. W. Worsoe had built an electric furnace in Vancouver for the purpose of manufacturing steel castings for the new floating dry dock building at the Wallace Shipyards, North Vancouver. Up to the present time Mr. Worsoe has been utilizing iron and steel scrap for his purposes but is considering the use of magnetite iron ore either as a mixture or as the entire charge and will make experiments towards that end in the near future.

The furnace at present being used in the Wallace foundry on Industrial island, False creek, is not adaptable for treating charges made up entirely of crude ore as it is for melting and refining rather than for smelting. It is of the 3-phase Gresen electric direct-arc, alternating current tilting type. The dimensions are as follows: Diameter, 6 feet 6 inches; length, 9 feet 6 inches, with a capacity to melt 8 tons of scrap in twenty-four hours, using electric power furnished by the British Columbia Electric Railway Company. This power is delivered at 2,200 volts and transformed down to between 115 and 135 volts.

The charging-door is at one end of the furnace, the dimensions of the door being 15 by 18 inches, which is operated by hydraulic power. The discharge is on the side of the furnace, which, when discharging, is tilted by hydraulic power.

The interior walls and roof of the furnace are constructed of silica brick imported from the East. Between the outer steel shell and the brick lining silocel sand is required for heat insulating purposes or to keep all the heat within the furnace. This sand is at present imported from Belgium.

That the operation of this furnace has been quite satisfactory for the purposes it has been used for, and that the castings made have fulfilled their purpose in every particular are sufficiently favourable testimonials to Mr. Worsoe, who has been able to show that it is unnecessary in future to import such castings into British Columbia as has been done in the past.

ALBERNI DISTRICT.

ALBERNI MINING DIVISION.

REPORT BY A. G. FREEZE, GOLD COMMISSIONER, ALBERNI.

I have the honour to submit the office statistics of the Alberni Mining Division for the year ended December 31st, 1923.

Mineral claims recorded	14
Certificates of work recorded	12
Free miners' certificates issued	34
Bills of sale recorded	1
Placer leases issued	3

Revenue.

Free miners' certificates	$151 50
Mining receipts, general	534 20
Total	$685 70

CLAYOQUOT MINING DIVISION.

REPORT BY W. T. DAWLEY, MINING RECORDER, CLAYOQUOT.

I have the honour to submit the office statistics of the Clayoquot Mining Division for the year ended December 31st, 1923.

Mineral claims recorded	25
Certificates of work recorded	10
Free miners' certificates	22
Powers of attorney, transfers, etc.	9
Other receipts issued	2

Revenue.

Mining receipts	$135 25
Free miners' certificates	89 75
Total	$225 00

QUATSINO MINING DIVISION.

REPORT BY ED. EVENSON, MINING RECORDER, QUATSINO.

I have the honour to submit the office statistics of the Quatsino Mining Division for the year ended December 31st, 1923.

Mineral claims recorded	17
Certificates of work recorded	54
Bills of sale recorded	3
Certificates of improvements	3
Free miners' certificates	30
Total revenue collected	$543 75

NANAIMO DISTRICT.

NANAIMO MINING DIVISION.

REPORT BY L. A. DODD, GOLD COMMISSIONER, NANAIMO.

I have the honour to submit the office statistics of the Nanaimo Mining Division for the year ended December 31st, 1923.

Free miners' certificates issued	141
Mineral claims recorded	89
Certificates of work	170
Bills of sale, powers of attorney, etc., recorded	42
Certificates of improvements	8
Permission to relocate	1
Placer leases issued	1

Revenue.

Free miners' certificates	$ 650 00
Mining receipts, general	1,816 00
Total	$2,473 00

VICTORIA DISTRICT

VICTORIA MINING DIVISION.

REPORT BY R. J. STEENSON, GOLD COMMISSIONER, VICTORIA

I have the honour to submit the office statistics of the Victoria Mining Division for the year ended December 31st, 1923.

Free miners' certificates issued (individual)	229
Free miners' certificates issued (company)	12
Free miners' certificates issued (special)	4
Mineral claims recorded	18
Certificates of work recorded	60
Certificates of improvements issued	9
Reverted Crown-granted mineral claims leased	4
Grouping notices filed	2
Powers of attorney recorded	1

Revenue.

Free miners' certificates	$2,760 00
Mining receipts, general	440 73
Total	$3,831 23

VANCOUVER MINING DIVISION.

REPORT BY A. P. GRANT, MINING RECORDER, VANCOUVER.

I have the honour to submit the office statistics of the Vancouver Mining Division for the year ended December 31st, 1923.

Free miners' certificates issued	1,815
Free miners' certificates issued (company)	51
Free miners' certificates issued (special)	11
Quartz claims recorded	74
Certificates of work issued	194
Surveys recorded as work	8
Receipts issued for money in lieu of work	19
Grouping notices and documents filed	30
Conveyances recorded	21
Certificates of improvements recorded	14

Revenue.

Free miners' certificates	$11,715 00
Mining receipts	2,745 25
Total	$14,460 25

NEW WESTMINSTER MINING DIVISION.

REPORT BY I. WINTEMUTE, MINING RECORDER, NEW WESTMINSTER.

I have the honour to submit the office statistics of the New Westminster Mining Division for the year ended December 31st, 1923.

Free miners' certificates issued	92
Mineral claims recorded	75
Certificates of work issued	85
Conveyances, etc., recorded	13
Grouping notices filed	8
Leases of reverted mineral claims	4

Revenue.

Free miner's certificates	$ 785 25
Mining receipts	441 35
Total	$1,226 60

INSPECTION OF MINES

REPORT BY GEORGE WILKINSON, CHIEF INSPECTOR OF MINES.

I have the honour to submit my annual report as Chief Inspector of Coal and Metalliferous Mines, covering the year ended December 31st, 1923.

Appended hereto are the reports of the District Inspectors relative to production of coal and coke, the number of persons employed, list of accidents and prosecutions, and brief descriptions of the mines in the several Inspectorates, and also reports of the Secretary to the Board of Examiners for coal-mine officials.

PERSONNEL OF STAFF OF INSPECTORS AND INSTRUCTORS.

Inspectors.

James McGregor	Chief Inspector, Victoria, January to May 31st.
George Wilkinson	Chief Inspector, Victoria, effective June 1st, 1923.
Robert Strachan	Senior Inspector, Fernie (Kootenay and Boundary Districts)
John MacDonald	Inspector, Fernie District
H. H. Johnstone	Inspector, Rossland District
Henry Devlin	Inspector, Nanaimo District
Thos. R. Jackson	Inspector, Nanaimo District
J. G. Biggs	Inspector, Merritt District
Thos. J. Shenton	Inspector, Prince Rupert District

Instructors, Mine-rescue Stations.

J. T. Puckey	Instructor, Fernie District
J. D. Stewart	Instructor, Nanaimo District
John Thomson	Instructor, Cumberland District
W. C. Stone	Instructor, Middlesboro District

By amendment to the "Coal-mines Regulation Act" during 1919 the Board of Examiners for coal-mine officials and miners was placed under the jurisdiction of the Inspection Branch. The personnel of the Board of Examiners for coal-mine officials is as follows:

George Wilkinson, Chairman.

James Dickson, Secretary, member of the Board, and Acting Inspector of Mines.

H. E. Miard, member of Board and Acting Inspector of Mines.

Messrs. Dickson and Miard and the District Inspector of the district in which an examination is being held form the Board for granting certificates of competency to coal-miners. An Inspector of Mines is empowered to grant provisional certificates to miners for a period not exceeding sixty days between regular examinations.

CHANGES IN THE INSPECTION STAFF DURING 1923.

James McGregor resigned as Chief Inspector and was superannuated. He was succeeded by George Wilkinson, who took office on June 1st. Mr. McGregor has been suffering from ill-health for over a year, which finally forced him to retire. The Department loses a valued servant and one who has served faithfully for twenty-six years as an Inspector, the latter three years as Chief Inspector.

Mr. Wilkinson served as Chief Inspector previously from March, 1917, until May, 1920.

COAL-MINES OF THE PROVINCE.

TONNAGE OF COAL PRODUCED.

The total gross tonnage produced by the coal-mines of the Province for the year ended December 31st, 1923, was 2,542,987 long tons, being a decrease of 37,928 long tons from the production of 1922.

The Coast District, which includes Nicola-Princeton, Vancouver island, and Telkwa coalfields, produced 1,802,456 tons, a decrease of 224,098 tons as compared with the previous year.

The Vancouver Island collieries produced during the year 1,574,663 tons, a decrease of 179,990 tons as compared with the previous year.

The Telkwa and Peace River mines in the Northern District produced 400 tons, a decrease of 608 tons as compared with the previous year.

The Nicola-Princeton District produced 227,393 tons, a decrease of 43,479 tons as compared with the previous year.

The Crowsnest Pass District produced 740,531 tons, an increase of 186,170 tons as compared with the previous year.

ACCIDENTS IN AND AROUND COAL-MINES.

During 1923 there were 6,149 men employed in and around the coal-mines. Twelve fatal accidents occurred, causing forty-five deaths.

The ratio of accidents per 1,000 persons employed was 7.32, compared with 4.66 in 1922; in 1921 the ratio was 1.45; in 1920 the ratio was 2.67; in 1919 the ratio was 2.10; in 1918 the ratio was 5.15; in 1917 the ratio was 8.51; in 1916 the ratio was 5.53; in 1915 the ratio was 10.42; in 1914 the ratio was 2.97, averaging 4.66 for ten years.

The following table shows the collieries at which fatal accidents occurred during 1923, and their relation to accidents which occurred in 1922:—

Name of Company.	Name of Colliery.	1923.	1922.
Canadian Collieries (D.), Ltd.	Comox, No. 4 mine	37	18
Western Fuel Corporation of Canada, Ltd.	Nanaimo, No. 1 mine	5	1
" " "	" Reserve mine	2	1
" " "	" Wakesiah mine	..	2
Middlesboro Collieries, Ltd.	Middlesboro	..	3
Crow's Nest Pass Coal Co., Ltd.	Coal Creek	..	1
Granby Cons. Mining, Smelting & Power Co., Ltd.	Granby, No. 1 mine, Cassidy	1	5
Totals		45	31

The following table shows the various causes of fatal accidents and their percentage of the whole, with corresponding figures for the previous year:—

Cause.	1923.		1922.	
	No.	Per Cent.	No.	Per Cent.
Asphyxiation	..	.....	1	3.23
"Blow-outs" (outbursts of coal and gas)	..	.....	2	6.45
Falls of rock	7	15.56	4	12.90
Falls of coal	..	.....	3	9.68
Mine-cars and haulage	4	8.89	1	3.23
Explosions	33	73.33	20	64.51
Miscellaneous (surface on screening plant)	1	2.22	..	.....
Totals	45	100.00	31	100.00

The following table shows the number of tons of coal mined for each fatal accident in their respective classes in the years 1923 and 1922:—

Cause.	1923		1922	
	No. of Fatal Accidents	No. of Tons of Coal mined per Fatal Accident	No. of Fatal Accidents	No. of Tons of Coal mined per Fatal Accident
Asphyxiation			1	2,580,915
Blow-outs (outbursts of coal and gas)			2	1,290,457
Falls of rock	7	393,141	4	654,229
Falls of coal			3	860,305
Mine-cars and haulage	4	635,747	1	2,580,915
Explosions	33	77,090	20	129,045
Miscellaneous (surface on screens)	1	2,542,987		

The number of tons of coal mined per fatal accident during 1923 was 76,511 tons, compared with 83,255 tons for 1922 and 85,921 tons for the last ten years.

EXPLOSIVES USED IN COAL-MINES.

The following table shows quantity of explosives used in coal mines during the year 1923, together with number of shots fired, how shots were fired, tons of coal produced per pound of explosive used, and the average pounds of explosive per shot fired:

District.	Quantity of Explosive used in Pounds	Tonnage for District	Total No. of Shots fired	Tons of Coal per Pound of Explosive used	Average Pounds of Explosive per Shot fired
Vancouver Island	406,234	1,374,663	505,537	3 38	0 783
Nicola-Princeton	57,076	227,393	71,438	3 98	0 798
East Kootenay	21,492	740,531	31,853	34 45	0 680
Northern District	150	400	172	2 66	0 872
Totals	545,952	2,542,987	609,000	4 65	0 795

The full list of explosives now on Permissible List and permitted for use in the coal mines of British Columbia are as follows:—

British List.

Monobel A1
Monobel No. 1
Monobel No. 4
Dynobel No. 4
Polar Permitite
Polar CXL-ite
Coalite "E" L.F.

United States List.

Monobel
Coalite "A" L.F.
Coalite "Y"
Monobel No. 4
"Giant" Coal-mine Powder No. 5
"Giant" Coal-mine Powder No. 6
"Giant" Coal-mine Powder No. 7
"Giant" Coal-mine Powder No. 8
"Giant" Coal-mine Powder No. 9
Polar Brushite
Vigorite No. 1
Vigorite No. 2
Vigorite No. 3
Vigorite No. 4
Miner's Friend No. 1

Miner's Friend No. 2 ..... United States List.
Miner's Friend No. 3 ..... „ „
Miner's Friend No. 6 ..... „ „
Miner's Friend No. 7 ..... „ „
Viking No. 1 ..... „ „

Permission was given by the Hon. Minister of Mines on April 24th, 1923, to add to the list Polar CXL-ite, which is known on the British List as Samsonite No. 3, and a supplementary order was issued to that effect.

Machine-mined Coal.

During the year mining-machines produced 125,258 tons of coal, or 4.92 per cent. of the total. Of the total machine-mined coal, Vancouver Island District produced 99,554 tons, or 79.6 per cent.; Nicola-Princeton District produced 16,644 tons, or 13.2 per cent.; and the East Kootenay District 9,060 tons, or 7.2 per cent.

The following tables give the district, number of machines, how driven, tons of coal produced, and the type of machine used:—

District.	No. driven by		Tons of Coal produced.		Total Tons (2,240 lb.).
	Electricity.	Compressed Air.	Electricity.	Compressed Air.	
Vancouver Island	2	19	7,569	91,985	99,554
Nicola-Princeton	..	3	.....	16,644	16,644
Crowsnest Pass	..	1	.....	9,060	9,060
Totals	2	23	7,569	117,689	125,258

Type of Machines in Use.

Type.	District.			Totals.
	Crowsnest Pass.	Nicola-Princeton.	Vancouver Island.	
Pick-quick cutter-bar	..	..	5	5
Siskol's punchers	..	..	11	11
Radialaxe punchers	..	..	2	2
Sullivan chain-cutters	..	..	3	3
Ingersoll-Rand punchers	..	3	..	3
Hardy punchers	1	..	..	1
Totals	1	3	21	25

Safety-lamps.

There were 5,008 safety-lamps in use in the coal-mines of the Province. Of this number 406 were flame-lamps of the Wolf type and 4,602 were electric lamps of various makes.

The following table shows the distribution of lamps by district, method of locking, and the illuminant used:—

District.	Method of locking Lamp.		Illuminant used.	
	Magnetic Lock.	Screw or Automatic Clip.	Naphtha.	Electricity.
East Kootenay	118	1,080	118	1,080
Nicola-Princeton	31	489	31	489
Vancouver Island	238	3,052	257	3,033
Totals	387	4,621	406	4,602

The following list of safety-lamps are permitted for use in the coal mines of British Columbia:—

Approved (Electric) Safety-lamps.

No. 1.—The electric lamp manufactured by the Edison Storage Battery Co., Orange, N.J., U.S.A., under approval No. 10 of the United States Bureau of Mines. This lamp shall be used with a flexible cord identified by the Bureau's specification CD-17. The only bulbs approved for use with this lamp are the symbol BM-10 bulbs, manufactured by the National Lamp Works of the General Electric Co., Cleveland, Ohio; the symbol BM-10 bulbs manufactured by the Edison Works of the General Electric Co., Harrison, N.J.; the symbol 2.5 V bulbs manufactured by the Miniature Incandescent Lamp Corporation, 25 Eighth Avenue, Newark, N.J., and the symbol BM-10 bulbs, manufactured by the Westinghouse Lamp Co., Bloomfield, N.J.

No. 2.—The Concordia approved portable electric (hand lamp) mine-lamp, manufactured by the Concordia Electric Co., Pittsburgh, Pa., under approval No. 12 of the United States Bureau of Mines. The only bulbs approved for use with this lamp are the symbol Osram, 0.85 to bulbs, sold by the Concordia Electric Co.

No. 3.—The Wico approved portable electric mine-lamp, manufactured by the Wittheier Igniter Co., Springfield, Mass., under approval No. 14 of the United States Bureau of Mines. This lamp shall be used with a flexible cord identified by the Bureau's specification CD-13. The only bulbs approved for use with this lamp are the symbol BM-14 bulb, manufactured by the Edison Lamp Works of the General Electric Co., Harrison, N.J.

No. 4.—The Concordia approved permissible portable electric mine-lamp, manufactured by the Concordia Electric Co., Pittsburgh, Pa., under approval No. 12 of the United States Bureau of Mines. This lamp shall be used with a flexible cord identified by the Bureau's specification CD-17. The only bulbs approved for use with this lamp are the BM-15 bulbs, manufactured by the National Lamp Works of the General Electric Co., Cleveland, Ohio.

No. 5.—The Pioneer approved portable electric mine-lamp, manufactured by the Pioneer Electric Mine Lamp Co., Philadelphia, Pa., under approval No. 16 of the United States Bureau of Mines. This lamp shall be used with a flexible cord identified by the Bureau's specification No. CD-31, and with battery-plates manufactured by the Electric Storage Battery Co., Philadelphia, Pa. The only bulbs approved for use with this lamp are the BM-16 bulbs manufactured by the Edison Lamp Works of the General Electric Co., Harrison, N.J.

No. 6.—The Wheat approved portable electric mine-lamp, manufactured by the Koehler Manufacturing Co. (Inc.), Marlboro, Mass., under approval No. 17 of the United States Bureau of Mines. This lamp shall be used with a flexible cord identified by the Bureau's specification Cd-31, and with battery-plates manufactured by the General Lead Battery Co., Newark, N.J. The only bulbs approved for use with this lamp are the BM-17 bulbs manufactured by the National Lamp Works of the General Electric Co., Cleveland, Ohio.

(Unless otherwise specified all lamps are cap-lamps.)

Approved (Flame) Safety-lamps.

No. 12.—The bonneted, double-gauze lamp, with magnetic lock, known as the Wolf lamp.

No. 13.—The flat-wick steel frame lamp, as specified in Approval No. 201 of the United States Bureau of Mines, manufactured by the Koehler Manufacturing Co., Marlboro, Mass., U.S.A.

No. 14.—The round-wick steel frame lamp, as specified in Approval No. 201-A of the United States Bureau of Mines, manufactured by the Koehler Manufacturing Co., Marlboro, Mass., U.S.A.

No. 15.—The flat-wick steel frame lamp, as specified in Approval No. 202 of the United States Bureau of Mines, manufactured by Ackroyd & Best (Ltd.), Arrott Power Building, Pittsburgh, Pa., U.S.A.

No. 16.—The flat-wick aluminium frame lamp, as specified in Approval No. 203 of the United States Bureau of Mines, manufactured by the Koehler Manufacturing Co., Marlboro, Mass., U.S.A.

No. 17.—The round-wick aluminium frame lamp, as specified in Approval No. 203-A of the United States Bureau of Mines, manufactured by the Koehler Manufacturing Co., Marlboro, Mass., U.S.A.

Approvals Nos. 201, 201-A, 203, and 203-A apply to magnetic-lock lamps that are equipped with steel gauzes. The only glasses approved for use with these lamps are marked "Macbeth No. 2100 High Speed." The only igniter approved for use with these lamps is the Koehler pyro internal igniter, 1915 model, using a cerium-zinc-copper alloy for igniter points.

Approval No. 202 applies to a magnetic-lock lamp. The only glasses approved for use with this lamp are marked as follows:—

ACKD
BEST
A-1

This lamp is relighted electrically. The only relighter approved for this lamp is the Ackroyd & Best underground relighter.

NOTE.—*While the use of flame safety-lamps is permitted, it is the policy of the Department of Mines to encourage the use of approved electric safety-lamps for all persons underground in the coal-mines, except such flame-lamps as may be required by the officials of the mines in the carrying-out of their duty.*

MINE-AIR SAMPLING IN COAL-MINES.

During the year 404 mine-air samples were taken in the coal-mines of the Province. Of this number, 146 samples were spoiled in transit, accidents in laboratory, or by reason of incomplete records.

Much valuable information has been obtained and added to that obtained in previous years relative to the flow of methane from the various coal-seams mined at the different collieries.

The table showing the tabulated data obtained from the mine-air sampling in coal-mines during 1923 is too voluminous to be printed with this Report, but the detailed analyses of all these gas samples is on file in the office of the Chief Inspector of Mines, where they can be examined by any person specially interested.

USE OF BURRELL GAS INDICATOR.

The latter part of General Rule 4, section 91, "Coal-mines Regulation Act, 1911," chapter 160, reads as follows: "It shall be incumbent on the owner, agent, or manager to provide a suitable gas tester or testers, of a type or pattern to be approved by the Chief Inspector of Mines, to enable the fireman to determine lower percentages of marsh-gas in the mine atmosphere of his district than can be determined by the ordinary safety-lamp."

The Burrell Gas Indicator is the approved tester for the purposes indicated above and is in general use throughout the coal-mines of the Province.

During the year, to test the efficiency of the above-named tester, a series of comparative tests were made by having a chemical analysis made of the air samples taken at the same time as readings of the tester were taken.

The following statistical table shows the results obtained:—

District.	Gas Sample taken and submitted by Inspector.	No. of Samples tested.	Average Percentage of Methane.	
			By Chemical Analyses.	By Burrell Gas Indicator.
			Per Cent.	Per Cent.
Crowsnest	J. MacDonald	53	0.99	1.03
Nicola-Princeton	J. G. Biggs	10	0.07	0.18
Vancouver Island	T. R. Jackson	63	0.85	0.89
"	J. Devlin and J. Dickson	149	0.84	0.88

The above comparative analyses show conclusively the practical utility and accuracy of the Burrell gas-tester as used in this Province.

The details of all the individual tests from which these averages are made up are on file in the office of the Chief Inspector of Mines.

MINE-RESCUE AND FIRST-AID WORK.

Considerable interest was manifested during the year in mine-rescue and first-aid work. There were twenty-seven certificates of competency in mine-rescue work issued by the Department during the year—one at Fernie Station, three at Cumberland Station, and twenty-three at the Nanaimo Station.

Considerable practice-work by regular trained crews is carried out at the stations regularly, in addition to the training of new men.

During the year considerable testing was carried out at the various stations of a small apparatus known as the "Self Rescuer." This apparatus, the manufacturers claim, will give

seventy minutes' protection in an atmosphere containing 1 per cent of carbon monoxide. From recent tests conducted under the supervision of the United States Bureau of Mines men wearing this apparatus were able to stay in an atmosphere containing 1.05 per cent carbon monoxide for a period of seventy-five minutes. Information received from the officials of the United States Bureau of Mines gives the assurance that this apparatus will be approved at an early date. While the effective use of this apparatus is conditional upon there being enough oxygen left in the atmosphere to sustain life, it has yet a wide field for application as in many cases after an explosion the majority of the fatalities is due to carbon monoxide poisoning, and no doubt some of those overcome would escape if they had some means of protection for a short time against carbon monoxide, as no doubt the oxygen content is sufficient to sustain life.

The Burrell Industrial Gas Masks have also been investigated during the year. The "Oxo All Service Gas Mask" gives complete protection against carbon monoxide, illuminating gas, and other poisonous gases, smoke, and dust. While this mask also is only of service when the oxygen content in the atmosphere is sufficient to sustain life, it has been proved of great service in dealing with mine fires. It is much lighter and more easily handled than the Self Contained Mine Rescue Apparatus of different type; its weight only being 3½ lb.

Four of these masks have been put in service by the Western Fuel Corporation of Canada, Limited, at the Nanaimo Mine-rescue Station.

LIST OF PERSONS WHO HAVE RECEIVED MINE-RESCUE CERTIFICATES DURING 1923

Name.	Where trained.	Certificate No.	Name.	Where trained.	Certificate No.
Ernest H. Ward	Fernie	537	James T. C. Pinfold	Cumberland	551
David Gourlay	Nanaimo	538	Thos. Eccleston	"	552
Henry C. Mainwaring	"	539	Edward Boyd	Nanaimo	553
Charles Bell	"	540	John Bramley	"	554
George Nash	"	541	William Bowater	"	555
James G. West	"	542	Michael P. Virostko	"	556
Robinson Wilson	"	543	John Louden	"	557
William P. Touhey	"	544	Joseph Wilson	"	558
Daniel Radford	"	545	John S. Morgan	"	559
Cal Beck	"	546	Peter M. Hunter	"	560
James Hitchin	"	547	David Coupland	"	561
Robert D. Moodie	"	548	Charles Cloke	"	562
James Rallison	"	549	John Morgan	"	563
Henry Jackson	Cumberland	550			

LEGISLATION.

During the year the following rules concerning the use of rock drills, removal of gas, and fencing off places were put into force, pursuant to the provisions of the "Coal mines Regulation Act," and during the session of the Legislative Assembly an Act to amend the "Coal mines Regulation Act" (chapter 47) was passed.

This amendment provides for the reporting of dangerous occurrences, whether personal injury or disablement is caused or not, and also provides for increasing the penalties for violation of the "Coal-mines Regulation Act."

"COAL MINES REGULATION ACT"

Pursuant to the provisions of section 119 of the "Coal mines Regulation Act," chapter 100, R.S.B.C. 1911, as amended by section 15, chapter 58, Statutes of 1919, the following rules are hereby established, viz.:—

(1.) Every percussive air drill used for the drilling of holes in coal shall be equipped with a water-jet or spray, or other appliance equally efficient, to prevent the escape of coal dust, and of a type approved by the Inspector of Mines.

(2.) The use of a compressed-air jet for forcibly removing accumulations of gas is strictly prohibited.

(3.) When accumulation of gas is being removed, the official in charge shall see that no person or persons or lights of any description are allowed on the return side of the gas being removed, unless at a sufficient distance away to allow of a proper diffusion of the gas to a percentage lower than the withdrawal point having taken place before it reaches them.

(4.) The term "properly fenced," as quoted in General Rule No. 6, shall mean a fence 4 feet high built of not less than three boards, 1 by 6, spaced so as not to obstruct the ventilation, and nailed securely to posts, or where there are no posts on the ribs, then the ends of the boards shall be hitched into the coal at least 3 inches and securely wedged.

(5.) All places fenced off as required under the terms of General Rules and Special Rules shall have securely attached to such fence in a conspicuous place a danger-signal properly worded, with the lettering at least 4 inches high; the lettering to be stencilled in white on a dark background, both to be of endurable material that will not easily become obliterated.

The above rules will come into force forthwith.

WILLIAM SLOAN,
Minister of Mines.

Victoria, B.C., February 16th, 1923.

CHAPTER 47.

AN ACT TO AMEND THE "COAL-MINES REGULATION ACT."

[*Assented to 21st December, 1923.*]

HIS MAJESTY, by and with the advice and consent of the Legislative Assembly of the Province of British Columbia, enacts as follows:—

1. This Act may be cited as the "Coal-mines Regulation Act Amendment Act, 1923."

2. Section 63 of the "Coal-mines Regulation Act," being chapter 160 of the "Revised Statutes of British Columbia, 1911," is amended by inserting between the eighth and ninth lines thereof the following words: "or where in or about any mine an occurrence within any of the following classes takes place, whether personal injury or disablement is caused or not:—

"(*c.*) All cases of ignition of gas or dust underground, other than ignitions of gas in a safety-lamp:

"(*d.*) All cases of fire underground:

"(*e.*) All cases of breakage of ropes, chains, or other gear by which men are lowered or raised:

"(*f.*) All cases of overwinding cages:

"(*g.*) All cases of inrush of water from old workings; or

"(*h.*) Any other dangerous occurrence."

3. Said chapter 160 is amended by inserting therein the following as section 108A:—

"108A. Every person who knowingly makes any false statement in any report or entry required under this Act to be recorded in any book kept at a mine shall be liable, on summary conviction, to imprisonment, with or without hard labour, for a term not exceeding two years."

4. Section 109 of said chapter 160 is repealed, and the following is substituted therefor:—

"109. Every person who is guilty of any offence against this Act shall, if no other penalty is prescribed elsewhere in this Act, be liable to a penalty not exceeding, if he is an owner, agent, or manager, one thousand dollars, or if he is any other person, one hundred dollars for each offence; and if the Inspector has given written notice of any such offence, then in case of an owner, agent, or manager to a further penalty not exceeding one thousand dollars and not less than one hundred dollars for every day after such notice that the offence continues to be committed, and in cases of other persons, to a further penalty not exceeding fifty dollars for every day after such notice that the offence continues to be committed."

SUPERVISION OF COAL-MINES.

During the year thirteen coal companies operated sixteen collieries, with thirty-seven mines, employing 4,264 men underground.

In the supervision of underground employees there were twenty-one managers, three safety engineers, thirty overmen, and 187 firebosses and shotlighters, a total of 241 officials, or one official for every eighteen persons employed underground.

I desire to express my appreciation of the faithful co-operation and assistance afforded me by the District Inspectors and the instructors in mine-rescue work.

BOARD OF EXAMINERS FOR COAL-MINE OFFICIALS.

FIRST-, SECOND-, AND THIRD-CLASS CERTIFICATES.

Report of James Dickson, Secretary of Board.

I have the honour to submit herewith the annual report of the transactions of the above Board for the year ended December 31st, 1923.

The Board of Examiners, which was formed on July 1st, 1919, at present consists of George Wilkinson, Chief Inspector of Mines, as Chairman; Harry Ernest Miard, member; and James Dickson, member and Secretary of the Board.

The meetings of the Board are held in the office of the Board, Mines Department, Victoria.

The examinations are held in accordance with rules made by the Provincial Board of Examiners and approved by the Minister of Mines, July 16th, 1919. As these rules were published in last year's Report there is no need to publish them again.

Two examinations for candidates for certificates of competency were held during 1923; the first being held on May 29th, 30th, and 31st, and the second on November 20th, 21st, and 22nd.

The total number of candidates at these examinations was as follows: For First-class Certificates, 10 (none passed); for Second-class Certificates, 6 (4 passed and 2 failed); for Third-class Certificates, 25 (15 passed and 10 failed); for Mine Surveyor Certificates, 4 (3 passed and 1 failed).

The following is a list of the candidates who successfully passed the examinations in the various classes:—

Second-class Candidates.—Daniel Morgan, Edward Morrison, James Duncan, and Albert Bastian.

Third-class Candidates.—James Rallison, John Chapman, John Pollock, William M. Frew, John McLaren, Leslie Dickie, Edward M. Groat, Henry C. Beard, Albert Bastian, Peter Hird-marsh, John Smellie, William Gregory, Walter McKay, and William King Hodge.

Mine Surveyor Candidates.—James S. Crosscombe, Joseph Sandland, and Robert T. Stewart.

EXAMINATIONS FOR CERTIFICATES OF COMPETENCY AS COAL-MINERS.

In addition to the examinations and certificates already specified as coming under the Board of Examiners, the Act further provides that every coal-miner shall be the holder of a certificate of competency as such. By "miner" is meant "a person employed underground in any coal-mine to cut, shear, break, or loosen coal from the solid, whether by hand or machinery."

The work of the Board of Examiners in examining candidates for coal-miners' certificates has been carried on in all mining districts at intervals of less than sixty days, as required by the amendment of the Act.

No certificates have been granted in any case where the candidate failed to satisfy the Board as to his general fitness, experience in a coal-mine, and a working knowledge of the English language.

During 1923 sixty-one examinations were held for candidates for certificates of competency as coal-miners in the various coal-mining districts of the Province and 425 certificates issued. In addition to above, a number of duplicate certificates were issued to coal-miners who had lost their original certificates of competency.

The Inspector of Mines in each district has authority under the amendment (1919) to the "Coal-mines Regulation Act" to grant, after a satisfactory examination, a provisional certificate of competency as a coal-miner to applicants, which entitles the holder to follow the occupation of a coal-miner for a period not exceeding sixty days or until the date of the next regular examination before the Board.

REGISTERED LIST OF HOLDERS OF CERTIFICATES OF COMPETENCY AS COAL MINE OFFICIALS.

FIRST-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL-MINES REGULATION ACT, 1877."

Name.	Date.	Name.	Date.
Shepherd, Francis H.	Mar. 5, 1881	Stockett, Thomas, Jr.	Aug. 3, 1901
Honobin, William	May 1, 1882	Cunliffe, John	Aug. 3, 1901
Little, Francis D.	May 1, 1882	Evans, Daniel	Aug. 3, 1901
Chandler, William	Dec. 21, 1883	Browitt, Benjamin	Aug. 3, 1901
Priest, Elijah	Dec. 21, 1883	McEvoy, James	Oct. 17, 1902
McGregor, James	Jan. 18, 1888	Wilson, A. R.	Oct. 17, 1902
Randle, Joseph	Jan. 18, 1888	Simister, Charles	Oct. 17, 1902
Matthews, John	Jan. 8, 1889	Hodge, Thomas	Oct. 17, 1902
Norton, Richard Henry	Aug. 20, 1889	Richards, James A.	Oct. 17, 1902
Kesley, John	Mar. 4, 1892	McLean, Donald	Jan. 21, 1904
Wall, William H.	May 30, 1893	Wilkinson, Geo.	Jan. 21, 1904
Wilson, David	May 30, 1893	Wright, H. B.	Jan. 21, 1904
Smith, Frank B.	May 30, 1893	Coulthard, R. W.	Jan. 21, 1904
Bradshaw, George B.	June 12, 1899	Roaf, J. Richardson	Jan. 21, 1904
Simpson, William G.	June 12, 1899	John, John	Jan. 21, 1904
Hargreaves, James	Feb. 5, 1901	Manley, H. L.	Jan. 21, 1904
Drinnan, Robert G.	Feb. 5, 1901		

FIRST-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT," 1904–1911–1919.

Name.	Date.	Name.	Date.
Baxter, Andrew	June 10, 1911	McCulloch, James	Sept. 10, 1910
Battey, Richard	May 27, 1913	McDonald, John	Oct. 3, 1919
Biggs, J. G.	July 22, 1908	McGuckie, Thomas	July 22, 1908
Bonar, Robert	Oct. 28, 1911	McKendrick, Andrew	May 27, 1913
Brace, Tom	May 13, 1915	McMillan, J. H.	Sept. 10, 1910
Bridge, Edward	July 22, 1908	McVicar, Samuel	May 1, 1909
Brown, David	May 21, 1914	Mazey, William John	Oct. 31, 1912
Brown, Robert Joyce	May 13, 1915	Miard, Henry Ernest	May 9, 1912
Caufield, Bernard	May 1, 1909	Millar, John K.	Nov. 22, 1906
Church, James A. H.	June 10, 1911	Miller, Andrew Anderson	Oct. 31, 1912
Cox, Richard	May 13, 1915	Montgomery, John W.	May 1, 1909
Crowder, James	June 10, 1911	Moore, Wm. H.	May 17, 1917
Cunningham, John Howard	May 9, 1912	Mordy, Thomas	Sept. 10, 1910
Davidson, W. A.	May 1, 1909	Mottishaw, Sam. K.	Nov. 15, 1917
Davies, David	June 10, 1911	Murray, George	June 21, 1921
Davies, Stephen	Nov. 15, 1917	Newbury, Arthur	June 21, 1920
Davies, Thos. Owen	May 21, 1914	O'Brien, George	May 21, 1914
de Hart, J. B.	May 17, 1917	Ovington, John	May 27, 1913
Derbyshire, James	Nov. 9, 1907	Peacock, Frank David	Oct. 28, 1911
Devlin, Henry	May 1, 1909	Penman, Hugh	May 21, 1914
Dickson, James	Oct. 31, 1912	Phelan, Arthur	May 27, 1913
Elliott, Daniel	Nov. 9, 1907	Powell, J. W.	June 10, 1911
Emmerson, Joseph	Nov. 9, 1907	Quinn, John Graham	July 8, 1916
Ewart, William	May 19, 1922	Ramsay, Peter Millar	May 16, 1918
Fairfoull, Robert	June 10, 1911	Roper, William	May 13, 1915
France, Thos.	Nov. 22, 1906	Russell, John	May 21, 1914
Fraser, Norman	Mar. 4, 1905	Scott, Thomas Wright	Dec. 22, 1921
Freeman, H. N.	May 1, 1909	Shanks, John	May 1, 1909
Galloway, C. F. J.	July 22, 1908	Shenton, T. J.	Sept. 10, 1910
Garman, Morris W.	Nov. 15, 1917	Shone, Samuel	May 1, 1909
Gascoyne, Rowland B.	May 21, 1914	Smith, A. E.	Oct. 28, 1911
Glover, Francis	Oct. 31, 1912	Smith, Joseph	July 22, 1908
Graham, Charles	Nov. 14, 1905	Smith, Thos. Edwin	Dec. 19, 1918
Graham, Thomas	Nov. 9, 1907	Spicer, J. E.	Oct. 28, 1911
Gray, James	Nov. 27, 1909	Spruston, T. A.	Nov. 27, 1909
Henderson, Robert	Nov. 27, 1909	Stevens, L. C.	Nov. 27, 1909
Hewlett, Howe	May 27, 1913	Stewart, R. T.	Sept. 10, 1910
Higgins, Alexander	Dec. 19, 1918	Strachan, Robert	Mar. 4, 1905
Holden, James	May 1, 1909	Strang, James	June 10, 1911
Howden, Archibald	May 27, 1913	Taylor, James	May 16, 1918
Howells, Nathaniel	Oct. 28, 1911	Thomas, J. D.	Sept. 10, 1910
Hughes, John C.	May 17, 1917	Thorne, B. L.	Sept. 10, 1910
Humphries, Clifford	June 10, 1911	Touhey, James	May 21, 1914
Hunter, Alex. B.	July 8, 1916	Walker, William	May 16, 1918
Huntrods, Eustace S. F.	May 19, 1922	Wallbank, J.	Sept. 10, 1910
Jackson, Thos. R.	Nov. 9, 1907	Warburton, Ernest Leonard	July 8, 1916
James, William	July 22, 1908	Wark, Samuel David	Oct. 3, 1919
Jaynes, Frank	May 13, 1915	Wesnedge, William	Dec. 19, 1918
Jemson, Jas. W.	May 27, 1913	Whittaker, John	Dec. 19, 1918
Kellock, George	June 10, 1911	Williams, John Samuel	Dec. 19, 1918
Knox, T. K.	July 27, 1909	Williams, Thos. B.	May 17, 1917
Laird, Robert	Nov. 15, 1917	Williams, Thos. H.	Nov. 22, 1906
Leighton, Henry	May 9, 1912	Wilson, Ridgeway R.	Nov. 15, 1917
Mackinnon, Hugh G.	May 19, 1922	Wilson, William	May 16, 1918
Macauley, D. A.	June 10, 1911	Wylie, John	July 22, 1908

SECOND-CLASS CERTIFICATES OF SERVICE.

Name.	Date.	No.	Name.	Date.	No.
Lee, John S.	Mar. 4, 1905	B 9	Walker, David	Mar. 4, 1905	B 14
Millar, J. K.	Mar. 4, 1905	B 10	Powell, William Baden	Mar. 4, 1905	B 16
McCliment, John	Mar. 4, 1905	B 11	Bryden, Alexander	Mar. 4, 1905	B 18
Hunt, John	Mar. 4, 1905	B 13			

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"

Name.	Date.	No.	Name.	Date.	No.
Adamson, Robert	Sept. 10, 1910	B 120	Dunsmuir, John	Nov. 14, 1905	B 26
Allan, Alex. McDiarmid	May 27, 1913	B 167	Duncan, James	Nov. 21, 1923	B 253
Almond, Walter	Nov. 15, 1917	B 213	Dykes, J. W.	May 1, 1909	B 77
Archibald, William	Nov. 22, 1922	B 250	Eccleston, Wm	May 1, 1909	B 87
Ball, Benjamin	June 21, 1920	B 235	Fairfoull, James	May 21, 1914	B 186
Barclay, Andrew	July 29, 1905	B 25	Fairfoull, R	May 1, 1909	B 83
Barlow, Benjamin Robt.	Dec. 19, 1918	B 229	Finlayson, James	July 29, 1905	B 21
Bastian, Albert	Nov. 21, 1923	B 256	Ford, Allan	May 27, 1913	B 171
Baybutt, Thomas	July 8, 1916	B 206	Foster, W. R	Nov. 25, 1909	B 102
Bell, John	May 17, 1917	B 212	Franey, Thos	May 14, 1906	B 27
Beveridge, William	June 21, 1920	B 233	Francis, David M	May 21, 1914	B 182
Bevis, Nathaniel	Sept. 10, 1910	B 123	Francis, Enoch	May 1, 1909	B 86
Biggs, John	May 1, 1909	B 94	Francis, James	July 22, 1908	B 63
Biggs, John G.	Nov. 2, 1907	B 40	Frater, George	July 8, 1916	B 204
Blair, James	May 13, 1915	B 197	Freeman, Henry N	Nov. 2, 1907	B 45
Brace, Tom	Nov. 27, 1909	B 96	Garbett, Richard	Oct. 31, 1912	B 161
Bridge, Edward	Oct. 23, 1906	B 33	Garman, Morris Wilbur	Oct. 31, 1912	B 155
Brown, David	Sept. 10, 1910	B 108	Gilham, John	June 21, 1920	B 237
Brown, George	Dec. 19, 1918	B 225	Gillespie, Hugh	July 29, 1905	B 24
Brown, James L.	Oct. 28, 1911	B 136	Gillespie, John	Oct. 23, 1906	B 36
Brown, John C.	Oct. 23, 1906	B 39	Gould, Alfred	May 13, 1915	B 190
Brown, John Todd	May 9, 1912	B 150	Gourlay, Robert	Dec. 19, 1918	B 227
Brown, R. J.	Oct. 28, 1911	B 134	Graham, Chas	Mar. 4, 1905	B 1
Brown, Robert	May 21, 1914	B 183	Gray, David	May 1, 1909	B 76
Brown, Robert Sneddon	May 13, 1915	B 196	Gray, George	July 8, 1916	B 207
Brown, William Gold	Dec. 19, 1918	B 228	Greenwell, Archibald	May 16, 1918	B 220
Brownrigg, John H.	May 17, 1917	B 124	Hamilton, Robert N	May 21, 1914	B 175
Bushell, J. P.	May 1, 1909	B 81	Hastings, Andrew P	Dec. 19, 1918	B 223
Carroll, Henry	July 22, 1908	B 62	Henderson, Robert	July 22, 1908	B 60
Caufield, Bernard	Oct. 23, 1906	B 30	Holliday, William	Dec. 19, 1918	B 230
Caufield, John	July 8, 1916	B 199	Horrocks, Abner G	June 10, 1911	B 130
Cawthorne, L.	May 1, 1909	B 93	Howells, Nathaniel	Nov. 27, 1909	B 97
Challinor, Jno. Thomas	May 27, 1913	B 169	Hudson, George	Sept. 10, 1910	B 121
Challoner, Jno. Arthur	May 21, 1914	B 178	Hughes, John C	Sept. 10, 1910	B 109
Churchill, James	July 22, 1908	B 65	Hutton, Isaac	May 21, 1914	B 185
Clark, Robt.	June 21, 1921	B 242	Hutton, John	May 9, 1912	B 154
Clarkstone, Wm. W.	May 21, 1914	B 180	Hynds, William	Dec. 14, 1920	B 240
Commons, Wm.	Sept. 10, 1910	B 115	Hynde, John	May 18, 1922	B 247
Coupland, George	May 16, 1918	B 217	Jackson, Thos. R	Mar. 4, 1905	B 5
Courtney, A. W.	Oct. 28, 1911	B 138	James, David	Nov. 2, 1907	B 58
Cox, Richard	May 9, 1912	B 143	Jarrett, Fred	May 1, 1909	B 84
Crawford, David	May 1, 1909	B 88	Jaynes, Frank	Sept. 10, 1910	B 111
Cunliffe, Thomas	May 1, 1909	B 78	John, Francis	July 8, 1916	B 200
Dando, John	May 27, 1913	B 164	John, Howell	Sept. 10, 1910	B 122
Daniels, David	Nov. 2, 1907	B 53	Johnson, Moses	May 1, 1909	B 75
Derbyshire, James	Oct. 23, 1906	B 32	Jones, Samuel	May 16, 1918	B 221
Davidson, Hugh	May 27, 1913	B 165	Jones, William T	July 22, 1908	B 66
Davies, Stephen	Sept. 10, 1910	B 113	Jordon, Thos	Nov. 27, 1909	B 104
Dennis, Fred. W.	May 21, 1914	B 174	Joyce, Walter	May 27, 1913	B 168
Devlin, Ernest H.	May 21, 1914	B 179	Kirkwood, John R	Oct. 31, 1912	B 160
Devlin, Henry	Nov. 2, 1907	B 44	Knowles, James E	Oct. 28, 1911	B 137
Dewar, Alexander	Oct. 31, 1912	B 162	Laird, Robert	May 17, 1917	B 210
Dickenson, Clifford	May 13, 1915	B 189	Lander, Frank	May 13, 1915	B 195

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

Name.	Date.	No.	Name.	Date.	No.
Lane, Joseph	May 9, 1912	B 142	Raynes, M. T.	Oct. 28, 1911	B 139
Lee, Robert John	Sept. 10, 1910	B 110	Reid, Wm.	Oct. 28, 1911	B 132
Littler, Matthew	Oct. 31, 1912	B 157	Renny, James	Oct. 28, 1911	B 140
Luck, George	June 10, 1911	B 128	Richards, Thomas	Nov. 2, 1907	B 57
Manifold, Albert	May 9, 1912	B 145	Richards, Samuel	May 9, 1912	B 152
Marsh, John	Nov. 15, 1917	B 216	Rigby, John	July 29, 1905	B 29
Mason, Joseph	May 13, 1915	B 193	Roberts, Ebenezer	Sept. 10, 1910	B 117
Massey, H.	Nov. 27, 1909	B 99	Robinson, William	July 22, 1908	B 69
Mather, Thomas	June 10, 1911	B 127	Rogers, George	May 1, 1909	B 79
Matusky, A.	May 1, 1909	B 91	Roper, William	May 9, 1912	B 141
Mayer, Ralph Waldo	May 9, 1912	B 144	Rowbottom, Thomas	May 16, 1918	B 222
Mazay, W. J.	Nov. 27, 1909	B 101	Russell, John	Nov. 2, 1907	B 47
Menzies, Fred	Dec. 22, 1921	B 244	Rutherford, Jasper	May 16, 1918	B 219
Merryfield, William	July 22, 1908	B 61	Scarpino, Francis	Dec. 19, 1918	B 226
Miard, Hy. E.	Sept. 10, 1910	B 107	Scott, Thomas Wright	June 21, 1921	B 241
Michek, John	May 17, 1917	B 188	Shanks, David	Oct. 31, 1912	B 159
Middleton, Robert	July 22, 1908	B 72	Shaw, Thomas John	May 27, 1913	B 166
Mitchell, Henry	July 8, 1916	B 201	Smith, John	Oct. 3, 1919	B 231
Monks, James	Nov. 2, 1907	B 55	Smart, Robert K.	Nov. 22, 1922	B 248
Moore, Wm. H.	May 21, 1914	B 173	Somerville, Alex.	Mar. 4, 1905	B 4
Morgan, John	Nov. 2, 1907	B 43	Spruston, Robert Lecce	July 8, 1916	B 202
Morgan, William	Dec. 19, 1918	B 224	Spruston, Thos. A.	Nov. 2, 1907	B 46
Morgan, Daniel	Nov. 21, 1923	B 254	Stafford, Matthew	June 10, 1911	B 131
Morris, John	July 22, 1908	B 67	Stewart, J. M.	May 1, 1909	B 95
Morrison, Edward	Nov. 21, 1923	B 253	Stobbart, Jacob	May 9, 1912	B 153
Morton, Robert W.	July 22, 1908	B 59	Stockwell, William	Nov. 2, 1907	B 56
Mottishaw, S. K.	Oct. 28, 1911	B 135	Strang, Thomas	Oct. 31, 1912	B 158
Murray, George	Oct. 3, 1919	B 232	Stubbs, Clement	May 18, 1922	B 245
Musgrave, J.	May 1, 1909	B 90	Sutherland, John	May 16, 1918	B 218
Myers, Peter	May 9, 1912	B 149	Taylor, James	May 13, 1915	B 194
MacKinnon, Hugh G.	Dec. 22, 1921	B 243	Taylor, Thomas	July 8, 1916	B 203
McLaughlin, Alex	May 13, 1915	B 191	Thomas, J. B.	Nov. 27, 1909	B 105
McDonald, J. A.	Oct. 28, 1911	B 133	Thomas, Joseph D.	Oct. 23, 1906	B 38
McDonald, John	May 27, 1913	B 172	Thomas, Daniel W.	Nov. 22, 1922	B 249
McFegan, W.	Nov. 31, 1909	B 106	Thompson, Joseph	Sept. 10, 1910	B 114
McFegan, Robert	May 18, 1922	B 246	Touhey, James	May 9, 1912	B 147
McGarry, Martin	Oct. 31, 1912	B 156	Touhey, William	July 8, 1916	B 205
McGuckie, Thomas M.	Oct. 23, 1906	B 35	Tonge, Thomas	July 22, 1908	B 71
McKelvie, J.	May 1, 1909	B 92	Tully, Thomas	Nov. 15, 1917	B 214
McKendrick, And.	Sept. 10, 1910	B 112	Vanhulle, Peter	Nov. 2, 1907	B 54
McLean, Michael D.	June 21, 1920	B 234	Virgo, John	May 1, 1909	B 89
McMillan, D.	June 10, 1911	B 125	Walker, William	May 13, 1915	B 192
McNay, Carmichael	May 9, 1912	B 151	Warburton, Ernest L.	May 27, 1913	B 170
McPherson, James E.	July 22, 1908	B 73	Watson, Adam G.	Nov. 14, 1905	B 28
Neen, Joseph	June 10, 1911	B 129	Watson, Arthur W.	May 17, 1917	B 211
Newbury, Arthur	May 21, 1914	B 184	Webber, John Frank	Mar. 4, 1905	B 3
Newton, Wm.	Sept. 10, 1910	B 116	Wesnedge, William	Nov. 27, 1909	B 98
O'Brien, Charles	May 9, 1912	B 148	White, John	Nov. 2, 1907	B 48
O'Brien, George	May 1, 1909	B 82	Whitehouse, William	Oct. 31, 1912	B 163
Osborne, Hugh	Dec. 14, 1920	B 239	Williams, John Samuel	Nov. 15, 1917	B 215
Ovington, John	Nov. 2, 1907	B 52	Williams, Watkin	Sept. 10, 1910	B 118
Park, William	June 21, 1920	B 238	Wilson, Robinson	May 21, 1914	B 177
Parkinson, T.	May 1, 1909	B 80	Wilson, Thomas	July 22, 1908	B 74
Parnham, Charles	Nov. 2, 1907	B 49	Wilson, William	July 22, 1908	B 70
Quinn, James	May 21, 1914	B 181	Wood, Thos. James	May 21, 1914	B 176
Quinn, John	May 9, 1912	B 146	Worthington, Joseph	May 1, 1909	B 85
Ramsay, Peter Millar	May 17, 1917	B 209	Yates, Frank	Nov. 22, 1922	B 251
Rankin, Geo.	Nov. 27, 1909	B 103			

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1914"

Name.	Date	No.
Adamson, Robert	May 1, 1909	C 323
Adamson, Wm.	Dec. 22, 1921	C 721
Ainsworth, Edward	May 16, 1918	C 674
Allan, Alexander	Oct. 28, 1911	C 430
Almond, Alex	Oct. 1, 1907	C 252
Almond, Walter	July 22, 1908	C 286
Alstead, Robt.	June 21, 1921	C 719
Anderson, John	Oct. 28, 1911	C 437
Anderson, Peter Blane	Nov. 15, 1917	C 699
Anderson, Robt.	Oct. 14, 1914	C 566
Angell, William	May 24, 1914	C 501
Arbuckle, John	May 13, 1915	C 622
Archibald, Geo.	May 24, 1914	C 569
Archibald, Thomas	Oct. 28, 1911	C 454
Ball, Alfred	May 17, 1917	C 625
Bann, Thomas	Oct. 31, 1912	C 494
Baggaley, J.	July 22, 1908	C 300
Bain, James	May 27, 1913	C 546
Bainbridge, James	Nov. 24, 1922	C 744
Ball, Benjamin	May 24, 1914	C 583
Barker, Robert	June 10, 1911	C 415
Barlow, B. R.	May 1, 1909	C 327
Bastian, Albert	May 30, 1923	C 750
Bateman, Joseph William	Oct. 28, 1913	C 551
Bauld, Wm.	June 10, 1911	C 422
Baxter, Robert	Oct. 28, 1911	C 450
Baybutt, Thomas	May 27, 1913	C 548
Beard, Henry C.	May 30, 1923	C 751
Beeton, D. H.	May 1, 1909	C 328
Bell, Fred	May 27, 1913	C 514
Bell, John	May 9, 1912	C 477
Bennett, Andrew M.	Nov. 15, 1917	C 691
Bennett, John	Oct. 14, 1914	C 597
Bennie, John	June 10, 1911	C 411
Beveridge, Wm.	June 10, 1911	C 386
Biggs, John	Mar. 4, 1905	C 210
Biggs, Thomas	Oct. 28, 1911	C 449
Birchell, Richard	Oct. 1, 1907	C 296
Blair, James	Oct. 31, 1912	C 502
Blewett, Ernest	July 22, 1908	C 298
Blinkhorn, Thomas	Dec. 19, 1918	C 681
Bradley, William	July 22, 1908	C 291
Bradley, Wilfred	May 17, 1922	C 733
Bridge, Edward	July 20, 1905	C 223
Briscoe, F.	July 22, 1908	C 309
Broderick, Matthew	Jan. 21, 1913	C 525
Brown, Arthur A.	Oct. 14, 1914	C 598
Brown, David	Nov. 1, 1909	C 348
Brown, George	July 8, 1916	C 629
Brown, George A.	Dec. 14, 1920	C 706
Brown, James	Sept. 10, 1910	C 364
Brown, James	June 10, 1911	C 412
Brown, James	July 8, 1916	C 625
Brown, Jas. Millie	May 13, 1915	C 615
Brown, John	Sept. 10, 1910	C 362
Brown, Robert	Oct. 28, 1911	C 451
Brown, Robert D.	June 10, 1911	C 423
Brown, Robert S.	June 10, 1911	C 408
Brown, Wm. A.	May 24, 1914	C 576
Brown, William Gold	July 8, 1916	C 620
Bruce, Preston	Dec. 14, 1920	C 712
Bullen, Thomas	Sept. 10, 1910	C 359
Bushell, Jas. P.	Oct. 1, 1907	C 294
Bysouth, Thomas	May 16, 1918	C 673
Cairns, Andrew	June 10, 1911	C 420

Name.	Date	No.
Cairns, Robert	May 27, 1913	C 529
Caldwell, Daniel	May 17, 1917	C 629
Caldwell, Peter	June 21, 1921	C 715
Calverly, Joseph	Sept. 10, 1910	C 375
Camamile, Hollis	Oct. 28, 1911	C 443
Campbell, Samuel	Nov. 15, 1917	C 692
Campbell, Andrew	Nov. 27, 1917	C 651
Carroll, George	Nov. 21, 1922	C 746
Carr, Peter	Oct. 31, 1912	C 497
Carson, George	Mar. 17, 1917	C 623
Catchpole, Charles	July 29, 1905	C 227
Caufield, Edward	May 16, 1918	C 670
Caufield, John	May 1, 1909	C 321
Challoner, Arthur	Oct. 28, 1911	C 433
Chambers, Ralph H.	Dec. 14, 1920	C 709
Chapman, Wm.	Dec. 22, 1921	C 730
Chapman, John	May 30, 1923	C 753
Charnock, John	Nov. 15, 1917	C 683
Cheetham, Ben	July 22, 1908	C 311
Chester, John	Oct. 28, 1911	C 440
Clark, Lewis	June 10, 1911	C 406
Clark, Walter Pattison	May 9, 1912	C 480
Clarkson, Robert	June 21, 1920	C 696
Clarkstone, Wm. W.	Oct. 28, 1911	C 431
Clarkstone, Hugh	May 17, 1922	C 736
Cleaves, Walter	May 9, 1912	C 475
Clifford, William	July 22, 1908	C 313
Colgrove, Charles Henry	Dec. 19, 1918	C 679
Commons, William	July 22, 1908	C 304
Compland, David	June 21, 1921	C 717
Cooke, Joseph	Mar. 4, 1905	C 209
Coomb, Alexander	May 27, 1913	C 543
Cooper, John Andrew	Dec. 19, 1918	C 680
Cope, Frank	Oct. 28, 1913	C 549
Coulthard, James	June 10, 1911	C 407
Crawford, David	Mar. 4, 1905	C 208
Cunningham, G. F.	Nov. 11, 1905	C 229
Cunliffe, Thos.	Oct. 1, 1907	C 295
Dabb, Owen	May 24, 1914	C 578
Dando, John	May 9, 1912	C 465
Davey, George	June 21, 1921	C 718
Davidson, Hugh	May 9, 1919	C 664
Davies, Alfred	Oct. 31, 1912	C 491
Davies, Evan Thomas	May 9, 1912	C 463
Davies, John H. C.	May 17, 1922	C 739
Davis, John David	May 16, 1918	C 669
Davis, William	May 1, 1909	C 320
Dean, Andrew	Dec. 19, 1918	C 688
Dean, Joseph	May 13, 1915	C 611
Derbyshire, A.	June 10, 1911	C 401
Dewar, Alex.	Sept. 10, 1910	C 369
Devlin, Edward	Oct. 23, 1906	C 241
Devlin, Ernest Henry	May 27, 1913	C 538
Devlin, John	Oct. 7, 1919	C 665
Dews, William	May 17, 1917	C 638
Dickenson, Clifford	May 27, 1917	C 702
Dickie, Leslie	Nov. 20, 1923	C 762
Dinzelole, Geo.	Oct. 28, 1911	C 439
Dobie, Thomas	Dec. 22, 1921	C 728
Doherty, J. J.	May 1, 1909	C 340
Doney, John	Mar. 4, 1905	C 211
Donnelly, John	June 10, 1911	C 425
Douglas, Robert	Oct. 28, 1911	C 455
Dorrance, Orlin William	Jan. 21, 1913	C 517
Douglas, D. H.	Oct. 23, 1906	C 235

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

Name.	Date.	No.	Name.	Date.	No.
Dow, And. Y.	May 21, 1914	C 587	Heyes, Edward	May 1, 1909	C 320
Drybrough, Robert	June 21, 1920	C 701	Hilley, Fred	July 22, 1908	C 290
Dunn, Wm.	Oct. 14, 1914	C 606	Hilton, Mathias	Dec. 19, 1918	C 677
Dunnigan, Richard	June 21, 1921	C 716	Hilton, R. G.	Sept. 10, 1910	C 376
Dykes, Isaac	June 10, 1911	C 409	Hindmarsh, Peter	May 30, 1923	C 755
Dykes, Joseph W.	Oct. 1, 1907	C 248	Hodson, R. H.	Mar. 4, 1905	C 216
Eccleston, Thomas	May 17, 1917	C 482	Hodge, William K.	Nov. 20, 1923	C 761
Eccleston, John I.	May 30, 1923	C 757	Holdsworth, William	May 16, 1918	C 671
Edwards, John	May 27, 1913	C 542	Holliday, William	July 8, 1916	C 634
Elliott, John	May 27, 1913	C 541	Horbury, Joseph W.	June 10, 1911	C 406
Elmes, George	Oct. 31, 1912	C 511	Horrocks, A. G.	May 1, 1909	C 324
Evans, D.	July 22, 1908	C 284	Horwood, S.	July 22, 1908	C 312
Ewing, Robert	May 13, 1915	C 608	Houston, Robert	July 8, 1916	C 631
Fairfoull, James	Oct. 28, 1911	C 453	Howells, Nathaniel	May 1, 1909	C 316
Farrow, John William	Dec. 19, 1918	C 683	Hutchison, Ben	Nov. 14, 1905	C 232
Ferryman, Henry	June 21, 1920	C 697	Hutchison, Fred	Nov. 27, 1909	C 358
Fitzpatrick, T. J.	Oct. 2, 1911	C 452	Hynd, John	Dec. 14, 1920	C 707
Flockart, David	Jan. 21, 1913	C 531	Hynds, William	July 8, 1916	C 632
Ford, Allen	Oct. 28, 1911	C 445	Ireson, John	Oct. 31, 1912	C 507
Fowler, Robert	Oct. 31, 1912	C 495	Irvine, David	June 10, 1911	C 413
Francis, David Morgan	Oct. 28, 1913	C 558	Jack, John	May 21, 1914	C 582
Francis, James	Oct. 1, 1907	C 250	James, Thos.	May 21, 1914	C 588
Frater, George	May 13, 1915	C 616	Jardine, Geo. Edward	Jan. 21, 1913	C 521
Freeman, H. N.	Nov. 14, 1905	C 230	Jarrett, Fred. J.	Oct. 1, 1907	C 256
Frew, William M.	May 30, 1923	C 752	Jaynes, Frank	July 22, 1908	C 277
Frew, Andrew	Nov. 27,1909	C 360	Jemson, J. W.	Mar. 4, 1905	C 205
Frodsham, Vincent	July 22, 1908	C 282	Jenkins, John	Sept. 10, 1910	C 390
Furbow, John	Jan. 21, 1913	C 528	John, Howel	July 22, 1908	C 305
Gabriel, Ernest P.	May 17, 1922	C 739	Johnson, Moses	Oct. 1, 1907	C 258
Garbett, Richard	Sept. 10, 1910	C 377	Johnston, Robert	May 9, 1912	C 479
Gascoyne, Rowland B.	Jan. 21, 1913	C 513	Jones, Alf. Geo.	May 21, 1914	C 584
Geater, Jas. Gordon	May 21, 1914	C 573	Jones, Samuel	May 27, 1913	C 518
Gemmell, James	Oct. 31, 1912	C 505	Jones, William C.	Jan. 21, 1913	C 556
Gillham, John	May 13, 1915	C 623	Jones, William Ernest	Oct. 28, 1913	C 221
Gillies, William	May 16, 1918	C 668	Jones, W. T.	Mar. 4, 1905	C 544
Glenn, James	Oct. 28, 1911	C 435	Joyce, Walter	Nov. 27, 1909	C 361
Gordon, Davis John	May 9, 1912	C 474	Judge, Peter	Sept. 10, 1910	C 391
Gourley, Robert	May 9, 1912	C 470	Keenan, Wm. James	June 10, 1911	C 426
Gray, George	May 9, 1912	C 467	Kelly, Ernest	May 17, 1917	C 646
Gregory, William	May 30, 1923	C 756	Kemp, Wm.	Oct. 14, 1914	C 594
Green, William	Nov. 15, 1917	C 659	Kingham, Alfred	Oct. 28, 1913	C 559
Greenhorn, John	May 21, 1914	C 575	Kirkeberg, H. S.	Nov. 27, 1909	C 350
Groat, Ed. Murray	Nov. 20, 1923	C 764	Klejko, Steve	Dec. 14, 1920	C 703
Griffiths, Edward	Oct. 31, 1914	C 508	Lane, Joseph	Oct. 1, 1907	C 254
Gunniss, Matthew	May 9, 1912	C 460	Lavin, Joseph	June 21, 1920	C 700
Haile, Joseph G.	May 17, 1922	C 731	Leeman, T.	May 1, 1909	C 345
Hallinan, William	May 1, 1909	C 343	Lester, Frank	May 17, 1922	C 734
Hall, Joseph	May 17, 1922	C 742	Lewis, Benj. J.	Sept. 10, 1910	C 386
Halsall, J.	July 22, 1908	C 307	Leynard, Paul	May 17, 1917	C 637
Hamilton, John	Oct. 28, 1911	C 444	Liddle, John	July 29, 1905	C 228
Hamilton, Robert Nesbitt	Oct. 28, 1913	C 550	Lindsay, William	May 17, 1917	C 642
Hampton, Samuel	Nov. 15, 1917	C 650	Linn, George Y.	May 17, 1922	C 737
Hancock, Arthur	Nov. 15, 1917	C 656	Littler, John	June 10, 1911	C 410
Hardy, Edward	June 21, 1920	C 694	Littler, Matthew	June 10, 1911	C 417
Hartley, Thomas	Oct. 31, 1912	C 510	Littler, Robert	June 10, 1911	C 418
Hart, Daniel M.	May 17, 1922	C 730	Livingstone, Alex	Oct. 28, 1911	C 436
Harwood, Fred	Sept. 10, 1910	C 384	Loxton, George	June 10, 1911	C 428
Harvey, Thomas	May 9, 1912	C 466	Loxton, John	June 10, 1911	C 416
Harvie, George	Sept. 10, 1910	C 378	Lloyd, Thomas	May 17, 1922	C 740
Heaps, Robert	Sept. 10, 1910	C 373	Luck, George	May 1, 1909	C 318
Hemer, Herbert	Oct. 14, 1914	C 595	Lynch, Stewart	Oct. 28, 1911	C 432
Henney, Jonathan	June 10, 1911	C 424	Mackie, John	June 10, 1911	C 421
Hendry, James	May 9, 1912	C 471	Makin, J. Wm.	Sept. 10, 1910	C 385
Herd, William	Dec. 19, 1918	C 682	Malone, John	May 21, 1914	C 585

Third-class Certificates issued under "Coal Mines Regulation Act Further Amendment Act 1904"—*Continued*

Name.	Date	No.
Malone, Patrick	Oct. 1, 1907	C 247
Maltman, James	Oct. 31, 1912	C 501
Mansfield, A.	May 1, 1909	C 329
Marrs, John	May 17, 1917	C 610
Marsh, Daniel Parks	May 27, 1913	C 543
Marsh, John	Oct. 1, 1907	C 270
Martin, James	June 10, 1911	C 398
Mason, Joseph	July 22, 1908	C 297
Massey, Henry	May 1, 1909	C 317
Mather, Thomas	July 22, 1908	C 283
Matusky, Andrew	Oct. 1, 1907	C 259
Mawson, J. T.	Nov. 27, 1909	C 359
Maxwell, Geo.	May 21, 1914	C 571
McAlpine, John	Mar. 4, 1905	C 217
McArthur, John Malcolm	May 17, 1917	C 618
McArthur, Robert	Dec. 22, 1921	C 723
McBroom, Al.	July 2, 1908	C 287
McCourt, John	Oct. 14, 1914	C 605
McCulloch, James	May 1, 1909	C 315
McDonald, John	Oct. 28, 1911	C 448
McFagen, Alexander	May 9, 1912	C 490
McFegan, Robert	June 21, 1920	C 638
McFegan, W.	May 1, 1909	C 319
McGarry, Martin	May 1, 1909	C 326
McGrath, James	July 8, 1916	C 630
McGuckie, Jno. M.	May 21, 1914	C 562
McGuckie, Thomas	July 29, 1905	C 226
McGuire, Thomas	Oct. 28, 1913	C 553
McIntyre, Neil	May 21, 1914	C 574
McKay, Walter	Nov. 20, 1923	C 763
McKelvie, J.	July 22, 1908	C 285
McKenzie, Peter	June 10, 1911	C 427
McKibben, Matthew	May 21, 1914	C 580
McKinley, John	Oct. 28, 1914	C 442
McLaren, John	May 30, 1923	C 754
McLaughlin, James	May 9, 1912	C 485
McLachlan, Alex	June 10, 1912	C 419
McLean, M. D.	Sept. 10, 1910	C 389
McLellan, William	Mar. 4, 1905	C 219
McLeod, James	July 22, 1908	C 286
McLeod, John	May 13, 1915	C 660
McMeakin, James	May 13, 1915	C 612
McMillan, D.	Sept. 10, 1910	C 397
McMillan, Edward	Oct. 31, 1912	C 493
McMillan, Neil	Nov. 15, 1917	C 654
McNay, Carmichael	July 22, 1908	C 306
McNeill, Adam L.	July 22, 1908	C 281
McNeill, Robert	Sept. 10, 1910	C 387
Meek, Matthew	May 9, 1912	C 484
Melkle, Harry Alexander	July 8, 1916	C 627
Menzies, Frederick	Dec. 14, 1920	C 704
Merrifield, George	Oct. 23, 1906	C 239
Merrifield, William	Oct. 23, 1906	C 238
Michek, John	May 21, 1914	C 563
Miles, John	June 10, 1911	C 414
Mitchell, Charles	May 1, 1909	C 322
Mitchell, Henry	Sept. 10, 1910	C 391
Monks, James	Nov. 14, 1906	C 234
Moore, George	Oct. 23, 1906	C 242
Moore, John	May 1, 1909	C 335
Moreland, Thomas	July 22, 1908	C 299
Morgan, John	July 29, 1905	C 224
Morgan, William	May 17, 1917	C 636
Morgan, Cornelius	Dec. 22, 1921	C 725
Morris, David	May 9, 1912	C 472
Mottishaw, Samuel K.	Oct. 23, 1906	C 237
Murdock, Jno. Y.	May 21, 1914	C 564
Myers, Peter	Oct. 28, 1911	C 446
Samson, T. H.	July 22, 1908	C 280
Nash, George William	May 17, 1917	C 595
Nash, George F.	Dec. 22, 1921	C 727
Nee, Wm. R.	Dec. 22, 1921	C 724
Neen, Joseph	Nov. 27, 1909	C 352
Nelson, Horatio	Oct. 1, 1907	C 253
Neilson, William	May 9, 1912	C 481
Newman, John	Oct. 14, 1914	C 606
Nicholson, James	May 9, 1912	C 489
Nimmo, James	May 9, 1912	C 461
Norris, Joshua	Oct. 28, 1913	C 557
Oakes, Robert	Oct. 31, 1912	C 498
O'Brien, Charles	Nov. 27, 1909	C 349
Odgers, Eli	Jan. 21, 1913	C 523
Orr, Alexander	Oct. 28, 1911	C 434
Osborne, Hugh	Oct. 28, 1913	C 555
Oswald, Geo. L.	Sept. 10, 1910	C 370
Owen, Thomas	May 1, 1909	C 347
Park, William	Dec. 19, 1918	C 684
Parks, Alexander	Jan. 21, 1913	C 519
Parker, L.	May 1, 1909	C 341
Parkinson, James Wm.	Nov. 15, 1917	C 655
Parkinson, T.	July 22, 1908	C 289
Parrott, Jas. E.	May 21, 1914	C 560
Parson, Herbert	May 13, 1915	C 621
Pearson, Jonathan	May 9, 1912	C 473
Penman, Hugh	Oct. 28, 1913	C 552
Perry, Geo. Harewood	May 17, 1917	C 643
Phillips, Richard S.	May 17, 1917	C 620
Phillips, James	Nov. 21, 1922	C 749
Pickup, A.	July 22, 1908	C 310
Picton, W.	May 1, 1909	C 333
Plank, Samuel	Nov. 14, 1906	C 233
Pollock, John	May 20, 1923	C 760
Poole, Samuel	May 27, 1913	C 536
Price, Walter	Sept. 10, 1910	C 371
Puckey, John Thomas	Dec. 19, 1918	C 687
Quinn, James	Oct. 28, 1911	C 441
Quinn, John	Oct. 28, 1911	C 429
Radford, Albert	May 21, 1914	C 579
Ralliem, R.	July 22, 1908	C 279
Ralliem, James	May 20, 1923	C 750
Rankin, George	July 22, 1908	C 275
Rankin, Wm. Shaw	May 9, 1912	C 480
Ratcliffe, Thomas	Oct. 1, 1907	C 251
Rayner, Fred	Oct. 1, 1907	C 267
Reid, Robert	Sept. 10, 1910	C 383
Reid, Thos.	May 21, 1914	C 582
Reid, Wm.	June 10, 1911	C 440
Reilly, Thomas	July 22, 1908	C 293
Renner, Jas.	Nov. 27, 1909	C 354
Richards, James	Nov. 1, 1907	C 249
Richards, Samuel	Oct. 23, 1906	C 244
Richardson, J. H.	Oct. 28, 1911	C 438
Rigby, John	July 29, 1905	C 225
Roberts, Ebenezer	May 1, 1909	C 327
Robinson, Michael	May 1, 1909	C 332
Robson, Thomas	May 21, 1914	C 566
Rogers, Ellis	May 13, 1915	C 624
Roger, William	July 22, 1908	C 274

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

Name.	Date.	No.	Name.	Date.	No.
Ross, William	June 21, 1920	C 702	Taylor, Thomas	May 21, 1914	C 577
Rowan, Alexander	Oct. 31, 1912	C 500	Thacker, Geo.	May 27, 1913	C 537
Rowan, John	Oct. 14, 1914	C 602	Thomas, Thomas	Sept. 10, 1910	C 365
Rowbottom, Thomas	Oct. 31, 1914	C 492	Thomas, John B.	Nov. 14, 1905	C 231
Royle, Edward	Oct. 31, 1912	C 506	Thomas, Joseph	Mar. 4, 1905	C 220
Russell, Robert	Nov. 27, 1909	C 351	Thomas, Warriett	Oct. 1, 1907	C 273
Rutherford, Jasper	May 17, 1917	C 644	Thomason, Charles	Nov. 15, 1917	C 657
Rutledge, Edwin	July 22, 1908	C 302	Thompson, Thomas	Oct. 1, 1917	C 267
Scales, Joseph	May 17, 1922	C 738	Thompson, John	Oct. 31, 1912	C 509
Scott, Henry	July 22, 1908	C 294	Thompson, Joseph	Oct. 1, 1907	C 269
Saunders, Eustace L.	Jan. 21, 1913	C 520	Thomson, Duncan	Mar. 4, 1905	C 218
Scarpino, Francis	May 17, 1917	C 649	Tolley, John	Dec. 19, 1918	C 678
Seddon, James	Oct. 3, 1919	C 692	Touhey, William	May 27, 1913	C 547
Shanks, David	Sept. 10, 1910	C 372	Travis, Joseph	June 21, 1920	C 699
Sharp, James	May 1, 1909	C 325	Tully, Thomas	May 9, 1912	C 468
Sharples, J. T.	Sept. 10, 1910	C 380	Tune, Elijah	May 9, 1912	C 476
Shea, Thomas J.	Dec. 22, 1921	C 722	Vardy, Robt.	May 21, 1914	C 570
Shearer, L.	May 1, 1909	C 330	Vaughan, John Henry	Oct. 28, 1913	C 560
Shields, Thomas	May 16, 1918	C 667	Vincent, Thomas C.	Nov. 21, 1922	C 745
Shipley, John W.	Oct. 28, 1911	C 456	Walker, George	July 8, 1916	C 633
Shooter, Joseph	Oct. 1, 1907	C 261	Walker, Jas. Alexander	Oct. 31, 1912	C 496
Shortman, J.	May 1, 1909	C 331	Walker, Robert C.	May 17, 1922	C 728
Simister, J. H.	Nov. 27, 1909	C 353	Walker, Wm.	May 21, 1914	C 586
Simister, W.	May 1, 1909	C 334	Wallace, Fred	Oct. 1, 1907	C 260
Sim, James	Dec. 14, 1920	C 711	Walls, John	Dec. 14, 1920	C 710
Simms, Hubert Allan	Jan. 21, 1913	C 526	Warburton, Ernest L.	June 10, 1911	C 399
Sinclair, William	Jan. 21, 1913	C 527	Ward, Ernest Hedley	May 17, 1917	C 641
Skelton, Thos.	May 1, 1909	C 344	Wardrop, James	Oct. 31, 1912	C 504
Smith, A. E.	Sept. 10, 1910	C 367	Watson, Adam G.	Mar. 4, 1905	C 212
Smellie, John	May 29, 1923	C 755	Watson, Arthur W.	May 27, 1913	C 535
Smith, John Watterson	May 16, 1918	C 665	Watson, George	July 22, 1908	C 288
Smith, Joseph	Mar. 4, 1905	C 207	Watson, Joseph	Jan. 21, 1913	C 515
Smith, Richard Beveridge	Oct. 28, 1913	C 561	Watson, William	Oct. 22, 1906	C 246
Smith, Thos. J.	Oct. 1, 1907	C 271	Watson, William	May 17, 1917	C 645
Smith, Thomas	May 9, 1912	C 486	Watson, John	May 17, 1922	C 743
Smith, Thomas	Dec. 14, 1920	C 705	Weaver, William	Nov. 17, 1922	C 748
Snow, Aubrey	June 15, 1918	C 675	Webb, Herbert	Oct. 28, 1911	C 457
Sopwith, Reginald Scott	Jan. 21, 1913	C 512	Webster, James Stewart	Dec. 19, 1918	C 685
*Sparks, Edward	Oct. 1, 1907	C 255	Weeks, John	Mar. 4, 1905	C 214
Spencer, G.	May 1, 1909	C 329	West, James Gloag	May 16, 1918	C 676
Spruston, R. L.	Nov. 27, 1909	C 355	Whalley, William	Dec. 19, 1918	C 686
Spruston, Thomas A.	Mar. 4, 1905	C 206	White, James	Oct. 31, 1912	C 499
Stafford, M.	Sept. 10, 1910	C 382	White, John	Oct. 22, 1906	C 245
Starr, Wallace	May 9, 1912	C 488	Wilkinson, Edward	Oct. 28, 1911	C 438
Staton, Edward	May 21, 1914	C 581	Williams, John Sam.	June 10, 1911	C 404
Steele, Walter	Oct. 28, 1911	C 439	Williams, Watkin	June 22, 1908	C 301
Stewart, George	May 27, 1913	C 534	Wilson, Robinson	June 10, 1911	C 397
Stewart, James M.	Oct. 23, 1906	C 240	Wilson, Thomas M.	Oct. 1, 1907	C 272
Stockwell, William	Oct. 23, 1906	C 238	Wilson, William	Oct. 1, 1907	C 262
Stone, Wm. C.	June 21, 1921	C 714	Wilson, William	May 17, 1917	C 674
Strachan, John	Oct. 14, 1914	C 604	Winstanley, Robert	Nov. 21, 1922	C 747
Strang, James	May 13, 1915	C 614	Winstanley, Oliver	May 17, 1922	C 741
Strang, Thomas	June 10, 1911	C 400	Winstanley, H.	July 22, 1908	C 283
Strang, Wm.	June 10, 1911	C 395	Wintle, Thomas A.	July 29, 1905	C 222
Sutherland, John	May 27, 1913	C 545	Witherington, George	Oct. 28, 1913	C 554
Sweeney, John	May 17, 1922	C 735	Wood, Thos. James	Oct. 31, 1912	C 491
Taylor, Charles M.	Mar. 4, 1905	C 213	Worthington, J.	July 22, 1908	C 295
Taylor, Hugh	Jan. 21, 1913	C 530	Wright, John	May 21, 1914	C 593
Taylor, James	May 21, 1914	C 567	Wright, Robert	May 21, 1914	C 589
Taylor, Jonathan	Dec. 19, 1918	C 680	Wright, William	Jan. 21, 1913	C 522
Taylor, J. T.	Oct. 28, 1911	C 447	Yates, Frank	May 17, 1922	C 732
Taylor, Leroy	Sept. 10, 1910	C 381	Young, Alexander	May 16, 1918	C 666
Taylor, Robert	June 21, 1920	C 695			

* C 314 issued in lieu of C 255 destroyed by Fernie fire.

COAL-MINE OFFICIALS.

Third-class Certificates issued under "Coal-mines Regulation Act Further Amendment Act, 1904," sec. 38, subsec. (2), in exchange for Certificates issued under the Coal-mines Regulation Act Amendment Act, 1901."

Name.	Date.	No.
Adam, Robert	Oct. 12, 1904	C 42
Addison, Thos.	Dec. 10, 1904	C 52
Aitken, James	Oct. 24, 1904	C 44
Allsop, Harry	Oct. 11, 1904	C 34
Ashman, Jabez	Feb. 5, 1907	C 131
Auchinvole, Alex	Mar. 29, 1905	C 89
Barclay, Andrew	April 27, 1904	C 19
Barclay, James	April 27, 1904	C 20
Barclay, John	April 17, 1905	C 111
Bickle, Thos.	Oct. 11, 1904	C 37
Bowie, James	May 13, 1905	C 116
Briscoe, Edward	Oct. 10, 1906	C 129
Campbell, Dan	Mar. 29, 1905	C 93
Carr, Jos. E.	Oct. 11, 1904	C 36
Carroll, Harry	Mar. 29, 1905	C 98
Clarkson, Alexander	April 27, 1904	C 18
Collishaw, John	Feb. 7, 1905	C 68
Comb, John	Mar. 23, 1904	C 2
Courtney, A. W.	Nov. 2, 1904	C 45
Crawford, Frank	April 6, 1904	C 7
Daniels, David	April 27, 1904	C 12
Davidson, David	April 3, 1905	C 105
Davidson, John	Mar. 29, 1905	C 87
Devlin, Henry	Oct. 12, 1904	C 41
Dobbie, John	Nov. 27, 1905	C 126
Dudley, James	Mar. 22, 1905	C 114
Duncan, Thomas	Aug. 29, 1906	C 128
Dunlap, Henry	Nov. 21, 1904	C 51
Dunn, Geo.	Dec. 19, 1904	C 56
Dunsmuir, John	Mar. 29, 1905	C 90
Eccleston, Wm.	Mar. 15, 1905	C 80
Fagan, David	April 6, 1905	C 109
Farquharson, John	April 27, 1904	C 17
Findlayson, James	June 6, 1904	C 25
Fulton, Hugh T.	April 3, 1905	C 105
Gibson, Edward	May 30, 1905	C 118
Gilchrist, Wm.	Mar. 29, 1905	C 85
Gillespie, Hugh	April 6, 1904	C 8
Gillespie, John	April 6, 1904	C 5
Gould, Alfred	April 17, 1905	C 112
Green, Francis	Oct. 11, 1904	C 38
Handlen, Jas.	June 16, 1904	C 122
Harmison, Wm.	Feb. 3, 1905	C 65
Hescott, John	Jan. 16, 1905	C 62
Hoggan, Wm.	June 6, 1911	C 134
John, David	Nov. 8, 1904	C 49
*John, Evan	July 25, 1916	C 140
Johnson, Geo.	May 9, 1904	C 124
Johnson, Wm. R.	Mar. 1, 1905	C 75
Jones, Evan	April 30, 1913	C 139
Lander, Frank	Jan. 9, 1905	C 61
Lanfear, Herbert	Jan. 27, 1905	C 63
Lewis, Thos	Oct. 11, 1904	C 35
Marsden, John	May 3, 1904	C 21
Mard, Harry E.	Mar. 3, 1905	C 76
Middleton, Robt	Feb. 11, 1905	C 71
Miller, Thos K	Feb. 21, 1905	C 74
McKenzie, John R	Oct. 12, 1904	C 40
McKinnon, Arch'd	April 3, 1905	C 102
McMillan, Peter	Mar. 29, 1905	C 94
McMurtrie, John	Mar. 29, 1905	C 96
Moore, Wm. H	June 17, 1905	C 119
Morris, John	Dec. 27, 1904	C 57
Myles, Walter	April 3, 1905	C 100
Nash, Isaac	June 1, 1904	C 120
Neave, Wm	Oct. 12, 1904	C 43
Nelson, James	April 27, 1904	C 16
Nimmo, Richard E	April 18, 1911	C 133
O'Brien, Geo	Feb. 6, 1905	C 66
Pearse, Thomas W. H	April 14, 1916	C 138
Power, John	Sept. 8, 1920	C 142
Price, Jas	Nov. 8, 1904	C 50
Rafter, Wm	Mar. 29, 1905	C 95
Reid, James	May 23, 1904	C 1
Richards, Thos	April 27, 1904	C 14
Ross, John	April 3, 1905	C 101
Roughead, George	Jan. 30, 1907	C 130
Ryan, John	Dec. 28, 1904	C 59
Sanders, John W	April 3, 1905	C 107
Shenton, Thos J	July 25, 1904	C 30
Shepherd, Henry	June 13, 1904	C 23
Smith, Geo	Mar. 29, 1905	C 84
Somerville, Alex	Mar. 24, 1904	C 3
Stauss, Chas F	Feb. 20, 1905	C 69
Steele, Jas	Mar. 29, 1905	C 92
Steele, John	June 4, 1913	C 4
Stewart, Duncan H	Mar. 28, 1904	C 137
Stewart, John	April 3, 1904	C 104
Stewart, Daniel W	May 16, 1904	C 27
Stoddart, Jacob	Feb. 21, 1905	C 73
Strachan, Robt	April 27, 1904	C 15
Strang, James	April 27, 1904	C 10
Sullivan, John	July 4, 1916	C 139
Summers, Joseph	May 17, 1920	C 141
Thomas, John	Mar. 29, 1905	C 97
Vass, Robt	Dec. 12, 1904	C 53
Vater, Charles	April 6, 1904	C 26
Webber, Chas	Sept. 13, 1904	C 32
Webber, Charles F	Sept. 13, 1904	C 33
Whiting, Geo	May 29, 1905	C 117
Wilson, Austin	Feb. 7, 1905	C 67
Wilson, Thos	April 27, 1904	C 11
Woodburn, Moses	Mar. 29, 1905	C 83
Yarrow, Geo	Nov. 7, 1904	C 46

* Issued in lieu of No. C 132, lost.

MINE SURVEYOR CERTIFICATES ISSUED UNDER THE "COAL-MINES REGULATION ACT AMENDMENT ACT, 1919."

Name.	Date.	No.	Name.	Date.	No.
Anderson, Harry C.	May 19, 1922	59	Miard, Harry Ernest	Oct. 3, 1919	2
Baile, Wynne Jeffreys	Oct. 3, 1919	16	McCulloch, Robert	Oct. 3, 1919	6
Bowerman, Everard S.	Dec. 14, 1920	39	Owen, Wm. Arthur	Oct. 3, 1919	10
Boyce, Joseph Patrick	Oct. 3, 1919	5	Priest, Elijah	May 19, 1922	53
Caufield, Bernard	May 19, 1922	54	Rafter, Wm.	May 19, 1922	51
Corbett, Garnett S.	May 19, 1922	49	Reger, Frederick Wm.	Oct. 3, 1919	7
Cox, Richard	May 19, 1922	57	Richards, Chas. Clifton	Oct. 3, 1919	19
Crosscombe, James S.	May 31, 1923	60	Ridley, James	Oct. 3, 1919	18
Daniell, Geo. W. B.	Oct. 3, 1919	29	Roaf, Jos. R.	Oct. 3, 1919	14
Davis, Gerald D.	Oct. 3, 1919	28	Richards, James A.	Oct. 3, 1919	15
Delaney, James	Oct. 3, 1919	21	Scott, Thos. Wright	Oct. 3, 1919	4
Dickson, James	Oct. 3, 1919	3	Strachan, Robert	June 21, 1920	36
Devlin, Henry	May 19, 1922	44	Spruston, Thos. A.	May 19, 1922	52
Drewry, Wm. Stewart	May 19, 1922	56	Strachan, Robert	May 19, 1922	45
Freeman, Harry N.	May 19, 1922	49	Sandland, Joseph	May 31, 1923	61
Garman, Maurice W.	Oct. 3, 1919	11	Stewart, R. T.	Nov. 17, 1923	62
Gregory, P. W.	Nov. 17, 1919	32	Townsend, Neville F.	Nov. 17, 1919	31
Graham, Charles	May 19, 1922	50	Vallance, Wm. Dixon	Oct. 3, 1919	8
George, Frank J.	May 19, 1922	48	Verkirk, Lucas	June 21, 1921	42
Hargreaves, James	Nov. 29, 1920	33	Waddington, Geo. W.	June 21, 1920	35
Hepburn, James T.	Dec. 14, 1920	37	Wark, Samuel David	Oct. 3, 1919	20
Holdsworth, William	Oct. 3, 1919	9	White, Harold	Oct. 3, 1919	25
Hughes, Edward	Dec. 14, 1920	38	Wilson, R. Robinson	Oct. 3, 1919	12
Hunter, George	Oct. 3, 1919	30	Wilson, Arthur Rupert	Oct. 3, 1919	13
Howden, Archibald	May 19, 1922	55	Wilson, Chas. Jas.	Oct. 3, 1919	22
Jackson, Thos. R.	May 19, 1922	43	Wilson, Hartley Paul	Oct. 3, 1919	24
King, Alfred Geo.	Oct. 3, 1919	27	Wilton, Douglas D.	May 19, 1922	59
Lancaster, Peter	Oct. 3, 1919	23	Wilkie, Octavius B. N.	Oct. 3, 1919	26
Lindoe, Luke	June 21, 1921	41	Wilkinson, George	Oct. 3, 1919	1
Lymn, Albert Crompton	Oct. 3, 1919	17	Wright, Austin	Dec. 14, 1920	40
MacDonald, John	May 19, 1922	46			

Department of Mines Mine rescue Shield—Cumberland Winners [illegible]

[illegible]

INSPECTION OF METALLIFEROUS MINES

NOTE.—Inspections of metalliferous mines are made under the "Metalliferous Mines Inspection Act," and under the terms of such Act the duties of the Inspector are limited to matters relating to or having an influence on the health or safety of the workmen employed in any metalliferous mine.

Under section 3 of such Act, the Inspector is prohibited from revealing any information in regard to ore-bodies or character of underground workings, or to give any information or opinion respecting any mine, obtained or formed by him in making such inspection.

NORTHERN INSPECTION DISTRICT

EXTRACTS FROM REPORT BY T. J. SIDNEY, INSPECTOR.

I have the honour to submit my annual report for the Northern Inspection District consisting of the Portland Canal, Nass River, Skeena, Queen Charlotte, and Atlin Mining Divisions.

ATLIN MINING DIVISION

This Division was not visited by me during the current year, as arranged by the Department. I therefore have no report for this section.

PORTLAND CANAL MINING DIVISION.

SALMON RIVER SECTION.

Premier. In this section is situated the *Premier* mine, operated by the Premier Gold Mining Company, Limited. D. L. Pitt, general manager; R. Smith, assistant manager; H. McDonald, mine foreman. Three hundred and fifty three men were employed in and about the mine. The operation of the mine has been continuous throughout the year. Improvements asked for in better bunk houses and conditions of sanitation have been granted; large and spacious bunk houses of good design have been erected during the year and other buildings have been arranged as pool rooms and places of recreation for the employees. Great credit is due the management for such a generous response in such matters.

First-aid work and safety-first work are in charge of Dr. Carson, resident physician, H. McDonald, mine foreman; and Messrs. Asseltine, Mustard, and Drysdale, officers of the company.

Only one matter remains unanswered by the management—namely, the air receivers complained of by me during the year; all other matters respecting operation comply fully with the "Metalliferous Mines Inspection Act."

B.C. Silver Mine. Owned by B.C. Silver Mines, Limited; C. A. Banks, manager, C. B. North, superintendent; C. Hult, mine foreman. Operation of this property continued all through the year and the number of men employed per day was fifteen. The work so far has been development in tunnel and crosscut, also diamond-drilling. The *Premier* mine adjoins this property and Dr. Carson has charge of the medical attendance of the employees.

All necessary provision respecting matters of safety first and first-aid work is cared for by the management, and all conditions of operation are kept within the terms of the "Metalliferous Mines Inspection Act."

Indian Mines. Owned by Indian Mines Corporation, Limited; G. B. le Turner, general manager; R. L. Clothier, superintendent; C. A. O'Neil, mine foreman. Development work in tunnel, crosscut, and raise has been carried on the whole of the current year and an average of twenty-five men employed. Accommodation in bunk-house, etc., I found to be sufficient and sanitary. A safety-first man is in charge constantly of the work of first aid and supplies for such purposes are kept constantly on hand. In case of all injury the services of Dr. Carson, of the *Premier* mine, are retained. In all my visits of inspection I found operative conditions to be in accord with the "Metalliferous Mines Inspection Act."

BEAR RIVER SECTION.

Prince John and Red Bluff. Owned by J. Nesbit and A. Archie, Stewart; bonded by C. A. MacKenzie, Victoria; J. Pope, manager. This property is situated on the western range of mountains bordering the Bear river at an elevation of 2,400 and 2,800 feet. At the time of my inspection twenty-one men were employed. The work consisted of development-tunnel operations. Adequate arrangements were in process for the accommodation of the men employed in building a new camp on the *Red Bluff* group. For taking proper care of the blasting material in use the manager informed me he intended to erect a temporary magazine at a safe distance from all buildings and ways of travel. I found all matters of operation to be in fair keeping with the law.

Dunwell. Owned by Dunwell Mines, Limited; H. J. Thomey, manager. I paid a visit of inspection to this property on August 1st of this year, at which time ten men were employed. Adequate provision for the men had been made in bunk-house and also other accommodation. I found the storing of powder too close to entrance of mine, and I pointed the matter out as being rather dangerous, and the manager promised to have the matter remedied without delay. All other conditions of operation I found to be well within keeping of the law.

PORTLAND CANAL SECTION.

Outsider. Owned by Granby Consolidated Mining, Smelting, and Power Company; J. Anderson, general manager; J. B. Haffner, assistant manager; J. A. Swanson, superintendent; J. Coulter, assistant superintendent; P. J. Cook, mine foreman. This property is situated at Maple bay, on the Portland canal, and operations commenced here in the fall of the year 1922; since that time the company has been very busy in arranging a camp, installing machinery, erecting bunkers, and constructing an aerial tram to carry the ore from the mine to the ore-bunkers and of a travelling-belt from the bunkers to convey the ore direct into the ship or scow. It is expected the property will be ready to make shipments early in the year 1924.

Work in opening up the mine and other works have been carried on all through the current year and the average number of men employed was thirty. A first-aid man is engaged by the company to take care of the injured and provision in case of serious accident is made for the transportation of same to Anyox by boat. In my inspections of the operation I have found conditions to comply with the "Metalliferous Mines Inspection Act."

NASS RIVER MINING DIVISION.

CASSIAR SECTION.

Rambler. Owned by Granby Consolidated Mining, Smelting, and Power Company; J. Anderson, mine foreman. This mine has been in continuous operation throughout the year and the average men employed was fifteen. All operative conditions are carried on under the requirements of the "Metalliferous Mines Inspection Act," and in all visits of inspection I have found the law to be complied with.

Hidden Creek. Owned by Granby Consolidated Mining, Smelting, and Power Company; V. Bengston, mine foreman. This mine has been in continuous operation all through the year, except on two occasions, one in which the camp was visited by a serious fire, which set off the main powder-magazine containing 94 tons of powder, and on a second occasion when there was a week or more of very heavy rain that caused a sudden overflowing of the lower dam near to the smelter, and a slide of rock that crushed in a part of the big flume that carries the water to the power-house. In both instances interference with the mine's operation ensued for a few days. The consequences to the company were serious in both instances. No injury resulted to any one from the explosion of the main powder-magazine and comparatively little damage was done. The average number of men employed for the year was 391.

Changes have taken place in the managing staff during the year. The assistant general manager, L. R. Clapp, left the locality of Anyox in the month of May of the current year and went to the *Copper Mountain* mine, and J. Haffner took up the assistant managership at Anyox in the month of June following. J. Tuttle, mine superintendent for the company, vacated the position at the end of the month of November, and J. A. Swanson was promoted to the superin-

tendency of the mines. Safety-first work is made a speciality by the managing officers of this company, I am most pleased to say.

As a specimen of the work done, the various grizzlies upon which much bulldozing of large chunks of ore has to be done, in order to minimize risk of any one being struck with rock from blast, and in preventing any one from approaching location while blasting is going on, a signal of warning in the shape of a glass box containing a light, on the glass of which is painted in large letters the word "Blasting," and this is located at a safe distance from where blasting is done, also an electric buzzer is set off when blasting is being done and continues until blasting is finished.

In all my visits of inspection during the year I have found all operation conditions to be strictly in compliance with the "Metalliferous Mines Inspection Act."

Golskeish.—This property, situated south of Granby Harbour about 2½ miles, has been closed down for the whole of the year.

OMINECA MINING DIVISION

HAZELTON SECTION.

Silver Standard.—This mine closed down early in 1922 and has remained idle during the whole of the current year.

SMITHERS SECTION.

Henderson. Owned by Federal Mining and Smelting Company; E. E. Wetherell, manager; J. Milligin, superintendent; J. Dean, mine foreman. This mine has been in continuous operation throughout the year with an average of fifty men employed. During the month of August, owing to a change in the ownership of the property, a change in management occurred; J. H. Turner, formerly manager for the Dathie interest, vacated his position, and his place was filled by E. E. Wetherell.

Safety-first and first-aid work is attended to by Wallace Walton, who was recommended for the position by the Compensation Board of this Province. Dr. Hankinson, of Smithers, is doctor in attendance for the employees.

The accommodation in bunk houses, mess-house, etc., is fair and conditions of sanitation are fairly satisfactory. In all inspections of the operation I have found the same to comply with the "Metalliferous Mines Inspection Act."

TELKWA SECTION.

Dome Mountain. Owned by Dome Mountain Gold Mining Company, Limited; H. Lee manager; H. M. Powell, engineer; A. Wyllie, mine foreman. Operations here commenced in February in shovelling snow and clearing the trail connecting the mine and the town of Telkwa, some 23 miles distant.

The average number of men employed for the period of February to December 31st was twenty. In first-aid work it may be said that the company employs a first-aid man and keeps a goodly supply of material necessary for use in such a service. Provision also is made of a room and two emergency beds to meet any case of injury that may be found unfit for transportation immediately to Telkwa, and Dr. Paine, of Telkwa, is employed to care for the injured.

The work of the management for the short period in clearing trail, building a camp, installing a plant, and sinking a shaft 100 feet deep has been one of huge proportion. I am pleased to say that every encouragement has been given by the management in the work of making the operation safe and the enforcement of the Act, which in all my visits of inspection I have found to be complied with.

SKEENA MINING DIVISION.

COAST SECTION.

Surf Inlet. Owned by Belmont Surf Inlet Mines, Limited; F. H. Peto, manager; P. W. Racey, superintendent; J. F. Collins, mine foreman. This mine has been operated continuously throughout the year. The average number of men employed was 210. The management has shown itself desirous of co-operating with the Inspector in the proper application of the "Metalliferous Mines Inspection Act."

Notwithstanding, it is a regrettable fact that we should have a list of four fatalities for the year. Three of which, I regret, were avoidable under normal conditions of ordinary care being exercised. One ignored orders and lost his life; a second fell from a steel skip upon which he had been riding, against the regulations of the mine, down the inclined shaft and was killed; and a third fell for some unknown reason into a raise in a part of the mine where he had no reason to be at the time, having left the main travelling-way to his place of work.

Pugsley. This is a small property owned and operated similarly by the Belmont-Surf Inlet Mines, Limited, and in the locality of Surf inlet. There has been continuous operation here throughout the year with an average number of twenty men employed.

Both operations comply with the "Metalliferous Mines Inspection Act."

DOUGLAS CHANNEL SECTION.

Drum Lummon. Owned by Drum Lummon Mines, Limited; G. A. Collins, general manager; D. G. Williams, superintendent; W. Leaverly, mine foreman. During the month of March of the current year I made an inspection of this mine. Seventeen men were employed at the time, and a kick-back aerial tram having a length of 1,700 feet was in course of construction. A compressor of 750 cubic feet capacity was installed, geared to a Diesel engine of 125 horse-power. I found bunk-house accommodation very poor and unsanitary in character. Other matters of operation I found to be in accord with the law.

QUEEN CHARLOTTE MINING DIVISION.

Very little mining, either in prospect form or in any other way, was being performed in this Division during the year and I thought it unnecessary to visit this Division.

KOOTENAY AND BOUNDARY DISTRICTS.

REPORT BY ROBERT STRACHAN, SENIOR INSPECTOR.

I have the honour to submit my annual report on the inspection of metalliferous mines in the Kootenay-Boundary District during the year 1923.

This district is in charge of Robert Strachan, Senior Inspector, while H. H. Johnstone acts as Inspector in the West Kootenay and Boundary District and John MacDonald in the East Kootenay.

WEST KOOTENAY AND BOUNDARY DISTRICT.

(From Report of H. H. Johnstone, Inspector.)

In this district no new mines were opened during the year. The Rossland mines of the Consolidated Mining and Smelting Company of Canada in the Trail district and the *Slocan Star* belonging to the Silversmith Mines Company in the Slocan were the two largest producers.

Trail District.

In this district the Consolidated Mining and Smelting Company's mines include the *War Eagle* and *Centre Star*. The *Le Roi* and *White Bear*; the *Le Roi No. 2*, which was acquired during the year; and the *I.X.L.* and *O.K.* were the only producing mines. In the early part of the year only necessary repair-work was being done in the Consolidated Company's Rossland mines; but, later, the production of ore was commenced when the Trail concentrator was relieved from the *Sullivan* ores and became available for the Rossland ores. Owing to this the number of workmen engaged in these mines increased from about seventy to about 300. During our inspection we have generally found these mines well ventilated and timbered and the safety of the workmen fairly well attended to.

The *I.X.L.* and the *O.K.* mines were working during the year with a small force of men, the first being busy all year with very encouraging results. These two mines are working only a small force of men, and we have generally found the conditions to be fairly good and the "Metalliferous Mines Inspection Act" fairly well complied with. The latter two mines are gold-bearing ores and the other Rossland mines are gold and copper.

At the Rossland mines fairly good change-rooms are provided for the workmen and kept in a sanitary state, while at the others the workmen change mostly at home and all the employees live in their own homes in Rossland; therefore there are no change or bunk houses.

Nelson District.

In this district there were only two mines working for a portion of the year, namely, the *Kootenay Belle* and the *Emerald*; while the *Nugget* and the *Queen*, both of which were worked the previous year, did not this year produce any ore.

The mines in this district, like the Trail mines, are mostly working on gold-bearing ores.

Slocan District.

In this district the *Slocan Star*, owned by the Silversmith Mines, Limited, was the largest producer and worked steadily during the year, along with the *Wonderful*, *Ruth Hope*, *American Boy*, *Bosun*, *Molly Hughes*, and *Standard*, all of which were producing silver-lead ores. The *McAllister* also worked steadily during the year, mostly on development work.

During our inspection we have generally found the conditions in and around these mines to be very good. The same applies to the *Hewett* and *Van Roi*, which were operated by lessees, although in the latter part of the year the *Van Roi* reverted to the owners.

Ainsworth District.

The *Cork-Province* worked a small force during the year, while the *Silver Bell*, *Silver Bear* and the *Florence* worked intermittently. The conditions in and around these mines were found fairly good, and in the case of the latter, the *Florence*, the gasolene locomotive previously used has been replaced with a storage-battery locomotive, which should prove more satisfactory.

Greenwood District.

The *Bell* and *Sally*, producing silver ores, worked steadily all year, and the *Spotted Horse* and *Combination* were working a very small force of men during the greater part of the year. The conditions in and around these mines were generally found to be very good; cook and bunk houses kept comfortable and sanitary.

Trout Lake District.

The *True Fissure* and *Cromwell* worked a small force of men steadily throughout the year, while the *Noble Five* was opened for a few months only during the summer. The general conditions in and around these mines were fairly good and the accommodation for the workmen comfortable.

EAST KOOTENAY DISTRICT.

There were seven mines working during the year. The *Sullivan* at Kimberley, owned by the Consolidated Mining and Smelting Company; the *Paradise* near Invermere, owned by R. R. Bruce; the *Steel* group at Brisco; the *Isaac*, the *Nip and Tuck*, and the *Park* group; these four are in the Windermere district. A small shipment was made at Marysville from the *St. Eugene* at Moyie. These mines produce silver, lead, or zinc. The principal producers were the *Sullivan* and the *Paradise*. The *Sullivan* is the largest producer of zinc and lead in the district, and, in fact, in the Province, having a production of over 2,000 tons a day.

In the early part of the year the ore was shipped to Trail for concentration, but the completion of the new concentrator at Kimberley about July allowed of this work being done there, and, while increasing the value, reduced the bulk of the shipments by a ratio of 6 to 1. The total output of the mine ran to nearly 500,000 tons and provides about 80 per cent. of the ores treated at the Trail smelter.

Unfortunately, during December trouble was experienced in dealing with this large output of ore owing to lack of power, notwithstanding the use of the total boiler plant and the company's own water-power. This was due to circumstances at the Bull River hydro-electric plant, where trouble was experienced from low water and ice, making it impossible to test out the new concentrator to its full capacity.

The Bull River plant is owned by the East Kootenay Power Company, which is at present installing another plant at Elko, 20 miles west of Fernie, on the Elk river. The Elk River plant is expected to develop about 15,000 horse-power, or about twice the capacity of the Bull

River plant, and with the duplication of the power-lines this trouble should be obviated in the future.

The present Bull River plant, in addition to supplying the *Sullivan* mine, provides power for the McGillivray Creek, the Coleman, Hillcrest, Bellevue, and Greenhill collieries in Alberta, as well as the towns along the Crow. Many of these collieries have reverted to their own steam plants, with the idea of conserving the power. The exceptionally low water and cold weather has been the chief source of trouble at Bull river.

Sullivan.

At the *Sullivan* mine a great many improvements have been made during the year, allowing of greater production and its treatment before being shipped to Trail smelter. The main tunnel has been increased from a width of 8 to 12 feet for a distance of 600 feet and the timber supports replaced with concrete and steel; the track-gauge has been increased from 18 inches to 3 feet, allowing of heavier locomotives and greater car capacity.

New automatic dumping-cars with a capacity of about 7 tons are now being used, hauled by electric locomotives of the trolly type, while two storage-battery electric locomotives are used inside for gathering the cars together. The blower-fan has been replaced by a fan of the Sirocco type, allowing of a greater volume of air being circulated in the working-places.

The two Nordberg compressors mentioned last year as being installed have been working for the greater part of the year very satisfactorily, and the power-house has been greatly improved by a concrete floor and the walls of the building made almost fire-proof by being treated with gunite, both outside and inside.

The change-room for the workmen has been doubled, without any sacrifice of the high standard previously maintained, and includes steel lockers for the workmen's clothes, porcelain wash-basins, with liquid-soap holders, shower-baths, individual latrines, urinals, sanitary drinking-fountain, and a separate portion of the building contains laundry-tubs for the convenience of those who desire to wash their clothes.

Convenient to the mine, although it seems more a part of the concentrator, is the new rough-rock crusher, where the ore is crushed to about 2 inches, with a capacity of handling 3,000 tons of ore a shift. The ore is dumped by the automatic dumping-cars into a huge circular reinforced-concrete bin, and is drawn from there to the jaw-crusher, then through two gyratory crushers, before being taken to the storage-bin. From the storage-bin the crushed ore is taken by railway-cars to the concentrator storage-bin, then through the roll crushers, and by conveyor to the storage-bins at the top of the concentrator, during which journey samples are taken at regular intervals.

The concentrator plant consists of Hardinge ball-mills and the latest designs in flotation and covers a large area of ground, its greatest length being 800 feet. Many features of this concentrator deserve notice, but the amount of thought and consideration to produce a concentrator providing ample room around the machines, freedom from belts and fly-wheels, dangers of fire, and ample light provision both by day and night reflects great credit on those who designed as well as those who carried out the construction.

The bunk-house accommodation at the *Sullivan* mine has been increased and now consists of eight, providing for the accommodation of about 300 men. The idea in providing separate bunk-houses instead of one large one is intended to prevent one shift interfering with the rest of the other shift, and is to be commended. All the bunk-houses are heated by steam from a central power plant and also hot and cold water, and are kept comfortable and sanitary. The high standard of the cook-house is still maintained, the dining-room being capable of seating over 300 men, the arrangement of tables being such to allow of this being done with the greatest dispatch.

During our inspections of the mine we have generally found the conditions to be very good, and every attempt being made to comply with the regulations, maintain good discipline, and ensure the safety of the workmen, as well as their health.

Paradise.

This mine is situated 20 miles from Invermere, on Spring creek, which flows into Toby creek, and has worked during the whole year. The mine is situated high up in the mountains, at an elevation of 7,200 feet above sea-level and about 5,000 feet above Invermere, at which point the ore is shipped by railway to Trail smelter. The ore consists of sand carbonates containing silver and lead values, but, owing to the expense of handling, only the richer portion of the ore is extracted for shipment.

The ground is very soft and entails great attention to timbering, the lagging having to be driven ahead of the extraction of ore. Under such conditions it is a pleasure to state that few accidents have been reported, reflecting great credit on the workmen and the officials in charge. The general conditions in and around the mine are very good and the bunk house and cook-house are kept both comfortable and sanitary.

INSPECTION.

In the larger mines an attempt is made to inspect these every month, the smaller ones frequently, and many of the smaller operations have not been visited during the year. In the case of the latter we very seldom get any notice of either opening, or closing, or reopening which frequently occurs.

In the West Kootenay and Boundary District thirty-seven mines were inspected during the year and 142 visits of inspection made, while in the East Kootenay District three mines were visited and twenty-five visits of inspection made. In practically every case the visit of inspection included a visit underground, during which all the working places were inspected.

VENTILATION.

The conditions with respect to ventilation were generally found fairly good, although in many cases the compressed air from the machine-drills and natural ventilation was the only source. In the larger mines with large stopes blower fans are sometimes used and as at the *Sullivan*, this was replaced with a Sirocco fan, giving very good results.

Twenty-seven samples of the mine-air were taken during the year, eight in the West Kootenay and Boundary District and nineteen in the East Kootenay District, of which three were lost either in transit or in the laboratory, and in no case have we had occasion to complain of the conditions, either in respect to dangerous gases or lack of oxygen. In this respect we wish to commend the action of the officials at the *Sullivan*, who are installing a method of taking mine-air samples to ensure a proper supply of good air for the workmen.

ACCIDENTS.

Thirteen accidents were reported during the year—two in the West Kootenay and Boundary District and eleven in the East Kootenay District. Twelve of these occurred inside the mine and one outside; two had fatal results, one in each district, and, on the basis of the number of workmen employed under and above ground, show a death rate of 2.35 per 1,000.

In the case of the first fatal accident, the workman who was assisting in replacing a tram on the track crossed between the electric locomotive and a tram, stepping on the coupling or the bumper, with his carbide-lamp in his hat he came in contact with the trolly wire carrying 550 volts, from which he received the shock which caused his death. This trolly wire is protected by a wooden trough at all points where workmen assemble or receive drills or supplies, but not on the other portions of the roadway, and is placed at such a height above the roadway that only by stepping on a car or the bumper of a car could a man come in contact with it. Unfortunately there was no person convenient with a sufficient knowledge of artificial respiration, which I believe would have provided a better chance to save his life.

In the second case, the workman who was employed as motorman's helper stepped off the electric locomotive while it was in motion, slipped, and was crushed to death. This class of accident can only be prevented by greater care on the part of the workmen and better discipline among the employees, which should be attended to by the officials.

Among the non-fatal accidents are other two due to haulage, one to fall of top rock, three to falling down raises, two to rocks rolling down the muck pile while loading ore, one to a fragment of steel flying off drill and striking the workman in the eye, one to rock falling down raise, and one to the hammer slipping while sharpening drills in the blacksmith shop.

In connection with accidents due to falls of either roof or sides I think an inspection made by an official of the working-places within a limited time previous to the workmen commencing work, and a report made as to the conditions existing which could be read by the workmen previous to entering the mine or commencing work would to a certain extent reduce these accidents.

In the case of the two fatal accidents an inquest was held, at which the Department was represented by the Inspector, and we wish to thank the Coroners for their courtesy in allowing us to examine the witnesses when necessary.

I wish to point out that some provision such as exists in the "Coal-mines Regulation Act" would be of great advantage in this respect, allowing of time to visit the scene of the accident before the inquest or adjourned inquest is held.

WELFARE-WORK.

At the *Sullivan* two classes in first aid to the injured were held during the year, and one at the concentrator at Kimberley, allowing the workmen an opportunity to receive instruction in this very desirable work of humanity. At each of the classes at the mine forty workmen were enrolled and thirty-five at the concentrator, and apart from the instruction will be a great help in co-operating to prevent accidents.

During the year at this mine an addition to the first-aid supplies has been made in the shape of two new H.-H. inhalators, by which "carbogen," a mixture of about 95 per cent. of oxygen and 5 per cent. of carbon dioxide, is administered to the unconscious person, the latest word in artificial respiration.

These are in addition to the two pulmotors already maintained, and the Proto mine-rescue apparatus has been replaced by four "All Service" masks, which provide in a very convenient and safe manner for the rescue of any workmen who may unfortunately have been overcome by noxious fumes from blasting operations.

In none of the other mines has any attempt been made to form classes in first aid to the injured or introduce means for resuscitating workmen, and I feel that the lead given by the *Sullivan* is well worthy of being followed.

In many of the small mines, prospects, or leases, situated far from medical aid, first-aid men and supplies are almost a necessity, and it seems pitiful how little attention is paid to this great work of humanity.

We again wish to thank the workmen and officials for their assistance in carrying out our duties during the year, and look forward to a continuation of the same in the ensuing year, 1924, realizing that it is only through their co-operation that the list of accidents, both fatal and otherwise, can be reduced and kept down to a minimum.

Attached is a list of accidents reported during the year and the report of H. H. Johnstone, Inspector for the West Kootenay and Boundary District.

NICOLA-PRINCETON INSPECTION DISTRICT.

EXTRACTS FROM REPORT BY JOHN G. BIGGS, INSPECTOR.

I have the honour to submit my annual report as Inspector of Metalliferous Mines for the Nicola-Princeton District for the year ending 1923.

HEDLEY SECTION.

Metal-mining has been rather quiet in this district during the present year, the only active operations being conducted by the Hedley Gold Mining Company at Hedley and the Kamloops Copper Company at Kamloops. During the year the Granby Mining Company absorbed the interests of the Canada Copper Company at Copper mountain, and as a result a large staff of employees has been engaged in construction-work both at the mine and the mill at Allenby, with the intention of greatly increasing the capacity of the plant. However, with the construction-work being completed and the unstable condition of the copper market, the mine has not been operated and work was practically suspended during the latter part of the year.

Nickel Plate. Gomer P. Jones, manager; Wallace Knowles, superintendent. This mine is situated on the Nickel Plate mountain, adjacent to and at an elevation of 3,800 feet above Hedley, where the mill is situated. This company suspended mining operations on November 1st and a number of the staff is at present engaged in extending the main or Dickson slope, thus making preparation for the lower ore-bodies, and also in the installation of a larger double-drum hoist at the top of this slope.

During the present year I have found the working conditions of this mine to be very good and the provisions of the "Metalliferous Mines Inspection Act" well adhered to, and it is gratifying to state that there has been no serious accident reported at this mine during the present year.

KAMLOOPS SECTION.

Iron Mask.

A. Wallinder, superintendent; J. Fisher, underground superintendent. This mine is situated 7 miles south-east of Kamloops and consists of two shafts, known as the *Iron Mask* and the *Erin*, situated at an elevation of 3,000 feet above sea-level, which are connected below for ventilation purposes. The *Erin* is well provided with ladder-ways and is only used as an air shaft, while the *Iron Mask*, situated at the north, is used as the working-shaft, from which the ore is drawn by skips, and it has been operated during the whole of the year.

During my inspections I have found the general conditions of the mine to be very good and the provisions of the "Metalliferous Mines Inspection Act" to be well adhered to, and I am pleased to state that no serious accidents have been reported at this mine during the year.

SOUTHERN COAST INSPECTION DISTRICT.

REPORT BY JAMES DICKSON, INSPECTOR.

I have the honour to submit my annual report as Inspector of Mines for the above district during the year ended December 31st, 1923.

Britannia Mining and Smelting Co.

C. P. Browning, general manager; James Moore, superintendent; W. Batten, assistant superintendent; Thos. McCulla, mine foreman; W. H. Mathieson, secretary-treasurer. The mines operated by this company are situated on Howe sound, about 28 miles from Vancouver, and are several miles inland. The ore is transported between the main tunnel of the mine (2,200 feet level) and the mill, which is on tide-water, by means of electric locomotive haulage, the difference in elevation being dealt with partly by the grade of the track and partly by a transfer-shaft 1,400 feet deep, into which the ore is discharged and reloaded on another electric haulage train at the bottom. This haulage-tunnel is 4,000 feet long and emerges a few hundred feet from the mill and on a level with the highest part of the mill. A comparatively small crew was employed at the mines pending the building of the mill, which was completed and put into operation at the end of February. From this time until the end of the year a crew of from 650 to 700 men was continuously employed.

There were four fatal accidents during the year, due to the following causes: one by man being squeezed in the main shaft, one by man going back on a presumed misfire shot, one by man falling through a grizzly, and one by being crushed by an ore train.

A "safety-first" organization has been inaugurated by means of which it is hoped that the individual co-operation of every employee will be secured. For this purpose the mines have been divided into four sections, and each section appoints two men who, with the foremen of the different sections, form a committee. The men so appointed, in company with the foremen, make a complete inspection of their district and make a report to the "safety-first" council.

Two new men are appointed each two weeks, and it is expected by having practically all the men brought directly into touch with this work, that accidents, both serious and slight, will be minimized.

In addition to above, the company gives a periodical bonus to the shift-boss having the least number of injuries on his shift.

Upon my inspections I have found the above mines to be well ventilated and well timbered where timbering was necessary, and the provisions of the "Metalliferous Mines Inspection Act" appear to be fully observed.

Tidewater Copper Co.

The mines operated by this company are situated at Sidney inlet, on the west coast of Vancouver island. The general manager of the company is Silas Silverman; resident superintendent, Charles J. Abrams. The mill is situated on sea-level and the mine is at an elevation of 1,700 feet. The ore is carried from the mine to the mill by means of a gravity aerial tramway. The bunk-house in connection with the mine is built a little below the elevation of the mine and has accommodation for fifty men. This mine was shut down early in December owing to market conditions. No serious accidents were reported during the year.

TONNAGE OF METALLIFEROUS MINES.

The output from the metalliferous mines for 1923 was 2,421,839 tons, being an increase of 848,653 tons over the tonnage for 1922. This tonnage was produced from seventy-seven shipping-mines, of which twenty-eight shipped over 100 tons.

ACCIDENTS IN METALLIFEROUS MINES.

There were twelve fatal accidents in and around the metalliferous mines during the year, causing the death of twelve persons, an increase of six in the number of fatalities compared with the figures for 1922.

There were 3,681 persons employed in and around the metalliferous mines, an increase of 1,508 persons compared with the figures for 1922.

The ratio of fatal accidents per 1,000 persons employed was 3.03, compared with 2.84 for 1922. The ratio for the last ten-year period was 2.936. The tonnage mined per fatal accident is 201,811 tons, compared with 262,197 tons per fatal accident during 1922.

The mines at which the fatalities occurred are:—

Mining Division.	Mine.	No. of Accidents.
Vancouver	Britannia	4
Skeena	Surf Inlet	4
Portland Canal	Premier	1
Fort Steele	Sullivan	1
Nass River	Hidden Creek	1
Trail Creek	Le Roi	1
Total		12

The following table gives the cause and percentage to the whole of the fatal accidents, with corresponding figures for 1922:—

Cause.	1923.		1922.	
	No.	Per Cent.	No.	Per Cent.
Falls of ground	2	16.67	2	33.33
Mine-cars and haulage	2	16.67	1	16.67
Powder-explosion and blasting	2	16.67	1	16.67
Shafts and hoisting	1	8.33	1	16.67
Falling down raises and stopes	4	33.33	..	....
Electrocuted	1	8.33	..	....
Miscellaneous	..	.....	1	16.66
Totals	12	100.00	6	100.00

LIST OF ACCIDENTS IN THE METALLIFEROUS MINES, 1923

KOOTENAY-BOUNDARY DISTRICT

REPORTED BY ROBERT STRACHAN AND H. H. JOHNSTONE, INSPECTORS

No.	Mine.	Date.	Name	Occupation	Injuries
1	Sullivan ..... (C.M. & S. Co.)	Mar. 13	John Campbell ...	Timberman.	Fell from staging into ore chute causing severe cuts on head and right wrist broken
2	Sullivan ..... (C.M. & S. Co.)	April 4	Jas. Kelley .	Miner	Fell going down ladder, fractured two ribs, left side
3	Sullivan ..... (C.M. & S. Co.)	May 28	Percy Johnstone	Mucker	Attempted to couple moving cars and was struck on jaw by one, fracturing the lower bone
4	Sullivan ..... (C.M. & S. Co.)	July 6	Jas. P. Robinson	Miner	Small piece of steel lodged in cornea of right eye
5	Sullivan ..... (C.M. & S. Co.)	" 18	E. H. Lendon	Mucker ...	Electrocuted when struck by trolley line. Fatal
6	Sullivan ..... (C.M. & S. Co.)	" 30	Fred Southern..	Miner	Simple fracture radius left arm, just above the wrist, when falling down muck pile
7	Sullivan ..... (C.M. & S. Co.)	Oct. 11	Ralph Watkins	Mucker operator	Broken knuckle of left thumb, caused when punch bar slipped
8	Sullivan ..... (C.M. & S. Co.)	" 16	Edwin Lundeen	Blacksmith	First two fingers of left hand broken when hammer slipped
9	Kimberley ..... (C.M. & S. Co.)	" 13	J. Lynch ...	Mucker ...	Bridge of nose broken, caused when struck by piece of rock
10	Kimberley ..... (C.M. & S. Co.)	Nov. 27	M. Tonich	Miner ...	Fracture of third toe, left foot, caused when piece of ore rolled on his foot
11	Kimberley..... (C.M. & S. Co.)	" 30	Malcolm McLeod	" ...	Fracture of small bone of second toe, right foot, caused when piece of ore rolled on his foot
12	Le Roi..... ..... (C.M. & S. Co.)	Dec. 20	Butre Bangelo ...	Motorman's helper	Was jumping off in front of motor when his foot caught between motor and centre of track, throwing him down. Fatal
13	Slocan Star ..... (Silversmith Mines, Ltd.)	May 2	Ole S. Olson ...	Miner	Fractured pelvis, caused by fall of rock.

COAST DISTRICT

REPORTED BY T. J. SHENTON AND JAMES DICKSON, INSPECTORS

14	Britannia M. & S. Co., Ltd.	Jan. 8	Wm. Jackson ...	Miner	Instantly killed when either attempting to reblast or the first fuse had hung fire until then
15	Britannia M. & S. Co., Ltd.	" 25	Arthur Robins.	Diamond drill helper	Fatally injured when caught between cage and second wall plate
16	Britannia M. & S. Co., Ltd.	May 4	Neil McLeod	Mucker	Lower right ribs and right hip bruised and lower chest crushed when caught between muck car and chute post in mine. (Subsequently died from injuries.
17	Britannia M. & S. Co., Ltd.	Sept. 5	John Stare .	Miner	Face and body badly bruised, fractured skull and concussion of brain, caused by falling through grizzly into ore chute. (Subsequently died from injuries.)
18	Surf Inlet ..... (Belmont-Surf Inlet M. Ltd.)	May 20	John Ambutch ...	"	Chest crushed by falling rock. Fatal
19	Surf Inlet. .. (Belmont-Surf Inlet M. Ltd.)	May 22	Edward Lifequist	Mucker	Crushed by falling rock. Fatal
20	Duthie Mines, Ltd.	June 19	Robt. L. Henry	Labourer	Struck on back by piece of rock while working at portal of tunnel
21	Premier G. Mines, Ltd.	June 19	Oscar Nelson	Miner	Killed by blast caused by drilling into powder in old blast hole
22	Hidden Creek. .. (G. C. M. S. & P. Co.)	Aug. 29	Steve Senador	Nipper .	Fell into ore pocket. Instantly killed
23	Hidden Creek ... (G. C. M. S. & P. Co.)	Oct. 25	Harry Wood	Timberman's helper	Injuries to back when falling rock jammed him against side of chute
24	Surf Inlet..... (Belmont-Surf Inlet M. Ltd.)	Nov. 3	Gus Laurin	Miner	Fatally injured when he fell down a raise
25	Pugsley..	Nov. 3	Kenneth S. Brown	Ore sampler	Fell down unlined shaft when he had slipped when stepping off skip. Fatal

COAL-MINING IN BRITISH COLUMBIA.

BY WM. FLEET ROBERTSON, PROVINCIAL MINERALOGIST.

During the year 1923 there was mined in the various collieries of the Province 2,542,987 tons (2,240 lb.) of coal, a decrease over the preceding year of 37,928 tons, equivalent to about 1.5 per cent.

The output of coke was 58,919 tons, as compared with 45,835 tons in 1922, an increase of 13,084 tons, or 28.5 per cent.

The following table shows, for the past eleven years, the output and the *per capita* production of the various districts:—

OUTPUT AND PER CAPITA PRODUCTION OF VARIOUS DISTRICTS.

Year.	District.	Gross Tons of Coal mined during Year.	Total No. of Employees at Producing Collieries.	Tons of Coal mined per Employee for Year.	Number of Men employed Underground in Producing Collieries.	Tons of Coal mined per Underground Employee for Year.
1913	East Kootenay District	1,331,725	2,666	500	1,965	678
	Coast District	1,239,035	3,777	328	2,865	433
	Whole Province	2,570,760	6,443	399	4,830	532
1914	East Kootenay District	955,183	2,397	399	1,749	547
	Coast District	1,211,245	3,335	363	2,518	481
	Whole Province	2,166,428	5,732	379	4,267	508
1915	East Kootenay District	852,572	1,748	488	1,183	721
	Coast District	1,120,008	3,230	347	2,512	446
	Whole Province	1,972,580	4,978	396	3,695	534
1916	East Kootenay District	882,270	1,674	527	1,125	784
	Coast District	1,603,310	3,386	474	2,569	624
	Whole Province	2,485,580	5,060	491	3,694	673
1917	East Kootenay District	551,751	1,481	372	944	584
	Coast District	1,846,964	3,689	501	2,816	656
	Whole Province	2,398,715	5,170	463	3,760	638
1918	East Kootenay District	732,864	1,327	552	814	900
	Coast District	1,845,860	4,100	450	2,844	645
	Whole Province	2,578,724	5,427	475	3,658	705
1919	East Kootenay District	558,806	1,369	409	1,000	559
	Coast District	1,850,142	4,597	402	3,145	588
	Whole Province	2,408,948	5,966	404	4,145	581
1920	East Kootenay District	847,389	1,582	536	1,062	798
	Coast District	1,849,385	4,767	388	3,129	591
	Whole Province	2,696,774	6,349	425	4,191	643
1921	East Kootenay District	759,755	1,774	428	1,207	629
	Coast District	1,809,884	5,111	354	3,515	515
	Whole Province	2,569,639	6,885	373	4,722	544
1922	East Kootenay District	554,361	1,538	360	1,063	521
	Coast District	2,026,554	5,106	396	3,649	551
	Whole Province	2,580,915	6,644	388	4,712	547
1923	East Kootenay District	740,531	1,434	516	965	767
	Coast District	1,802,456	4,556	395	3,299	546
	Whole Province	2,542,987	6,149	413	4,342	585

While no figures can be given as to the actual cost of mining in the different fields, the *per capita* production of these fields is of interest, as having a bearing upon the working costs and as indicating the mining facilities existing and the improvement made in these conditions from year to year.

The *per capita* production varies from year to year and this variation is very often caused by different conditions which last for a longer or shorter time. For example explosions, new developments, and the opening-up of new mines or closing of old ones are variable factors which affect the *per capita* production from year to year.

In the year 1917 it will be observed that while the *per capita* output of the Coast collieries shows an increase, the Crowsnest District shows a very considerable decrease, which is caused by the fact that a large amount of the underground labour in these collieries is engaged in non-productive work, such as repairing the damage from the former explosion and in opening up a new system of mining which it is expected will tend to greater safety of employees and a use of the property.

The *per capita* production for 1920 shows a substantial increase over that of 1919, particularly in the East Kootenay District, but in 1921 the *per capita* production dropped back again, with a slight increase in 1922, and in 1923 the *per capita* production shows a fair increase.

The market of the East Kootenay field is provided primarily by the railways of the south-eastern part of the Province and of the northern parts of the adjoining States of Montana and Washington, approximately three-quarters of the coal, sold as such, being exported to these States, while the remainder went to supply the demands of the south-eastern part of the Province—its domestic needs, its railways, steamboats, mines, and smelters.

Coke, a product of the coal-mines, is sold in the same markets, with the difference that the local consumption—chiefly by the smelter at Trail—took about 59 per cent. of the product, while 41 per cent. was exported to the States mentioned.

As regards marketing conditions in this field, the East Kootenay collieries are, however, brought into direct competition with the collieries of Alberta, just over the Provincial boundary line, all these collieries being in the same coalfield, with practically the same grade of coal and working under similar conditions.

The Coast District may be subdivided into two fields—the Nicola-Princeton field and the Vancouver Island field—in which the markets differ considerably.

The coalfield on the Telkwa river, in Omineca Division, this year produced 335 tons of coal which was sold locally, while a new property in the Peace River canyon produced 65 tons. The production of these two fields has been included in the Coast District.

In the Nicola-Princeton field the consumption is chiefly by the local railways, while a small amount finds its way to Vancouver, even under the handicap of what seems to be an excessively high freight charge.

The Vancouver Island coal market is provided by the domestic and manufacturing requirements of the Coast cities, and of the ocean going steamers calling at these ports.

The larger coasting steamers and railways, which in later years have all been using California crude oil as fuel, are to some extent reverting to the use of coal, which will mean an increased production from Coast collieries.

As in former years, the greater proportion of the coal production was made by three larger companies—the Crow's Nest Pass Coal Company, with two collieries in East Kootenay; and by the Western Fuel Corporation of Canada, Limited (formerly Canadian Western Fuel Company) at Nanaimo, and the Canadian Collieries (Dunsmuir), Limited, the latter two operating on Vancouver Island.

In addition to these large collieries, shipments have been made by the Corbin Coal and Coke Company, in East Kootenay; by the Middlesboro Collieries, Fleming Coal Company (operating Coal Hill Colliery) in the Nicola valley, Coalmont Collieries, Limited, on Tulameen river, and the Chu Chua Colliery, on the North Thompson river; by the Princeton Coal and Land Company, of Princeton; by the East Wellington Coal Company (formerly British Columbia Coal Mining Company, which was the Vancouver Nanaimo Coal Company), and Nanoose Collieries, Limited, near Nanaimo; and by Granby Colliery No. 1 at Cassidy and the Old Wellington mines, operating on Vancouver Island. Telkwa Collieries Company, of Telkwa, and the Peace River coal property mined and sold locally 400 tons between them.

The details of the shipments made by each of these companies will be found in reports of the Inspectors of the various districts.

During the year 1923 about 58.66 per cent. of the coal, sold as such by the collieries of the Province, was consumed in British Columbia; and the remainder, 41.34 per cent., was exported to the United States, including Alaska. Of the coke sold, about 59 per cent. was consumed in British Columbia, and the remaining 41 per cent. was exported to the United States.

COLLIERIES OF THE COAST DISTRICT.

The gross output of the Coast District collieries, including the Nicola valley and Telkwa, for the year 1923 was 1,802,456 tons (2,240 lb.) of coal actually mined, while some 5,225 tons was added to "stock," making the actual consumption of coal 1,797,231 tons.

Of this gross consumption, 1,457,848 tons was sold as coal, 156,846 tons was consumed by the producing companies as fuel, and 182,537 tons was lost in washing. Coal mined at some of the Vancouver Island collieries was sold to the Granby Company's Anyox smelter, where it was subsequently made into coke in by-product ovens by the Smelting Company for its own use.

Formerly, in 1902, the Coast collieries exported to the United States 75 per cent. of the coal they sold, but later these conditions changed very much, as is shown by the following table:—

TABLE SHOWING PERCENTAGE SALES DISTRIBUTION OF COAST DISTRICT COAL.

Year.	Used in Canada.	Exported to U.S.	Exported to other Countries.
	Per Cent.	Per Cent.	Per Cent.
1910	71.30	24.50	....
1911	76.10	21.60	2.30
1912	71.25	21.25	7.47
1913	89 80	10.20	....
1914	77.30	22.70	....
1915	67.00	33.00	....
1916	63.00	37.00	....
1917	60.00	37.00	3.00
1818	66.00	30.00	4.00
1919	72.00	28 00	....
1920	79.00	20.00	1.00
1921	78.47	21.53	....
1922	74.60	25.40	....
1923	86.81	13.19	....

COLLIERIES OF THE EAST KOOTENAY DISTRICT.

The gross output of the collieries of the East Kootenay District for the year 1923 was 740,531 tons (2,240 lb.) of coal actually mined, while 993 tons was added to stock, making the actual consumption of coal 739,538 tons. Of this gross consumption of coal, 590,521 tons was sold as coal, 59,253 tons was consumed as fuel by the producing companies, while 89,764 tons was converted into coke, producing 58,919 tons of coke; 537 tons of coke was added to stock, making the coke sales for the year 58,382 tons.

The East Kootenay collieries exported to the United States about 60 per cent. of the coal sold and about 41 per cent. of the coke.

The following table gives complete details of the coal and coke production of the Province for 1923, with the output figures for each colliery and district totals:—

Collieries of British Columbia—Production, 1923.

Mine	Sold. In Canada.	Sold. In U.S.	Sold. Elsewhere.	Total Sales.	Lost in Washing.	Used in making Coke.	Used under Co.'s Boilers, etc.	Total for Colliery Use.	Stocks. First of Year.	Stocks. Last of Year.	Difference. Added to.	Difference. Taken from.	Output for Year 1923.
Vancouver Island	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons (2240 lb.).
Canadian Collieries (D.) Ltd.—S. Wellington	52,859			52,859	28,912		4,662	28,574					81,433
Extension	101,119	47,362		148,681	45,919		13,300	59,279	2,089	6,426	4,337		212,287
Cumberland	224,468	2,225		226,628	46,325		4,914	51,239	7,283	5,634		1,649	270,218
Western Fuel Corp. of Can.—No. 1, Nanaimo	245,585	36,102		281,687	11,788		37,301	48,989	6,388	7,324	936		331,612
Harewood	1,153	169		1,322			1,100	1,100					2,422
Reserve	149,343	21,955		171,298	10,989		28,881	39,870	55	1,349	1,294		212,402
Wakesiah	70,726	10,308		81,126	5,261		12,012	22,573	442	742	300		103,099
Nanaimo-Wellington Coal, Ltd.—Wellington	56,230	9,634		65,864	13,423		7,668	21,121	2,415	1,368		1,047	85,938
East Wellington Coal Co.—East Wellington	25,709			25,709			2,565	2,565		481	481		28,690
Pacific Coast Coal Mines, Ltd.—Morden Slopeah													
Old Wellington (King & Foster)	11,040			11,040			32	32					11,072
Granby Cons. M. S. & P. Co., Ltd.—Cassidy	150,692	28,468		179,010	24,020		24,096	48,686	1,111	1,949	838		228,534
Totals, Vancouver Island	1,068,762	156,453		1,225,215	189,537		141,431	323,968	19,793	25,973	8,176	2,696	1,574,663
Nicola-Princeton District													
Middlesboro Collieries, Ltd.	70,139			70,139			5,811	5,811	536	448		88	75,802
Princeton Coal & Land Co.	13,950	770		14,720			2,012	2,012	100	13		87	16,645
Coalmont Collieries, Ltd.	77,992	45,684		123,676			7,156	7,156					130,832
Fleming Coal Co., Ltd.	3,508			3,508			456	456	80			80	3,964
Chu Chua Coal Co., Ltd.	100			100									100
Totals, Nicola-Princeton District	165,779	46,454		212,233			15,435	15,435	716	461		255	227,393
Telkwa-Peace River District													
Telkwa Collieries, Ltd.	335			335									335
Groat Creek Coal Co.													
Peace River Coal Property	65			65									65
Totals, Telkwa-Peace River District	400			400									400
Grand Totals, Coast District	1,234,941	202,907		1,437,848	189,537		156,866	339,403	20,509	26,434	8,176	2,951	1,802,456
Crowsnest Pass District													
Crow's Nest Pass Coal Co., Ltd.—Coal Creek	113,114	284,396		397,510			35,625	35,625	115	743	628		433,536
Michel	111,483	51,406		162,889		69,764	14,376	100,140					263,029
Crowsnest Coal & Coke Co., Ltd.—Fernie	1,997	51,655		53,652			4,272	4,272		307	307		49,380
Totals, Crowsnest Pass District	226,594	387,457		614,051		69,764	54,273	140,037	115	1,050	935		745,945
Coal													
Total Coal for Province	1,461,535	589,911		2,051,899	189,537	69,764	210,669	480,970	20,624	27,484	9,111	2,951	2,548,401
Coke													
Vancouver Island—Canadian Collieries (Coke)													
East Wellington (Crow's Nest Pass Works)	14,614	73,306		14,306					177	714	537		14,919
Total Coke for Province	14,614	73,306		14,306					177	714	537		14,919

COLLIERIES OF BRITISH COLUMBIA—MEN EMPLOYED, 1923.

Mine.	White Men.																		Indians.			Japanese and Chinese.									Total Men employed.		
	Supervision and Clerical.			Miners.			Helpers.			Labourers.			Mechanics and Skilled.			Boys.			Labourers.			Miners.			Helpers.			Labourers.					
	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.
Vancouver Island.																																	
Canadian Coll. (D.), Ltd.—S. Wellington	10	4	14	132	..	132	..	..	..	36	8	44	11	14	25	..	8	8	..	..	..	..	..	..	..	..	..	..	21	21	189	55	244
Extension	33	18	51	302	..	302	12	..	12	125	30	155	21	49	70	..	23	23	..	..	..	..	..	..	..	..	..	6	60	66	499	180	679
Cumberland	45	22	67	91	..	91	2	..	2	78	42	120	99	81	180	..	7	7	..	..	..	119	..	119	99	..	99	60	39	99	593	191	784
Western Fuel Corp. of Canada—																																	
No. 1, Nanaimo	26	28	54	210	..	210	.	..	..	159	75	234	96	47	143	47	24	71	..	1	1	..	..	..	..	..	..	..	67	67	538	242	780
Harewood	3	3	6	17	..	17	..	..	..	5	2	7	1	2	3	..	2	2	..	..	..	..	..	..	..	..	..	..	6	6	26	15	41
Reserve	15	13	28	159	..	159	..	..	..	77	47	124	16	28	44	35	24	59	..	1	1	..	..	..	..	..	..	..	45	45	302	158	460
Wakesiah	7	9	16	96		96	..	..	..	46	29	75	27	19	46	11	10	21	..	..	..	..	..	..	..	..	..	..	16	16	187	83	270
Nanoose-Wellington Collieries, Ltd.—																																	
Wellington	11	8	19	115	..	115	49	..	49	28	13	41	6	25	31	15	2	17	..	..	..	..	..	..	..	..	..	..	18	18	224	66	290
East Wellington Coal Co.	5	1	6	78	..	78	..	..	..	13	5	18	5	9	14	4	6	10	..	..	..	..	..	..	..	..	..	1	20	21	106	41	147
Pacific Coast Coal Mines, Ltd.—Morden	..	1	1	..	..	..	..	..	..	..	2	2	..	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	5
Suquash	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1
Old Wellington (King & Foster)	3	..	3	18	..	18	11	..	11	..	7	7	..	4	4	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	32	12	44
Granby C. M. S. & P. Co., Ltd.—Cassidy	12	11	23	201	..	201	..	..	..	..	88	88	89	38	127	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	302	137	439
Totals, Vancouver Island	170	119	289	1419	..	1419	74	..	74	567	348	915	371	318	689	112	107	219	..	2	2	119	..	119	99	..	99	67	292	359	2998	1186	4,184
Nicola-Princeton District.																																	
Middlesboro Collieries, Ltd.	12	5	17	66	..	66	19	..	19	54	19	73	..	14	14	..	8	8	..	..	..	..	..	..	..	..	..	..	..	..	151	46	197
Princeton Coal & Land Co.	4	3	7	10	..	10	11	..	11	8	9	17	..	4	4	..	3	3	..	..	..	..	..	..	..	..	..	..	..	..	33	19	52
Coalmont Collieries, Ltd.	9	9	18	95	..	95	..	..	.	51	51	102	1	14	15	1	3	4	..	..	..	..	..	..	..	..	..	1	1	157	78	235
Fleming Coal Co., Ltd.	2	1	3	16	..	16	4	.	4	3	3	6	..	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	25	6	31
Chu Chua Coal Co., Ltd.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals, Nicola-Princeton District	27	18	45	187	..	187	34	..	34	116	82	198	1	34	35	1	14	15	..	..	..	..	..	..	..	..	..	1	1	366	149	515
Telkwa-Peace River District.																																	
Telkwa Collieries, Ltd.	5	1	6	6	..	6	..	..	..	..	..	..	.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11	1	12
Aveling Coal Property	..	..	..	..	..	..	..	..	..	..	..	..	..	.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Peace River Coal Property	..	2	2	2	..	2	..	..	..	..	..	.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	4
Totals, Telkwa-Peace River Dist.	5	3	8	8	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13	3	16
Grand Totals, Coast District	202	140	342	1614	..	1614	108	..	108	683	430	1113	372	352	724	113	121	234	..	2	2	119	..	119	99	..	99	67	293	360	3377	1338	4,715
Crowsnest Pass District.																																	
Crow's Nest Pass Coal Co., Ltd.—																																	
Coal Creek	24	14	38	304	..	304	..	..	..	65	54	119	171	104	275	11	12	23	..	..	..	..	..	..	..	..	..	.	..	575	184	759
Michel	14	13	27	208	..	208	..	..	..	36	163	199	77	68	145	1	9	10	..	..	..	..	..	..	..	..	..	4	4	336	257	593
Corbin Coal & Coke Co., Ltd.—Corbin	4	9	13	24	..	24	13	..	13	7	..	7	5	18	23	1	1	2	..	..	..	..	..	..	..	..	..	..	..	..	54	28	82
Totals, Crowsnest Pass District	42	36	78	536	..	536	13	..	13	108	217	325	253	190	443	13	22	35	..	..	..	..	..	..	..	..	..	4	4	965	469	1,434
Grand Totals for Province	244	176	420	2150		2150	121	..	121	791	647	1438	625	542	1167	126	143	269	..	2	2	119	..	119	99	..	99	67	297	364	4342	1807	6,149

NOTE.—U=underground; A=above ground; T=total.

Fort Victoria
24th August 1852.

Mr Joseph McKay

Sir,

1 You will proceed with all possible diligence to Wentuhuysen Inlet commonly known as Nanyms Bay, and formally take possession of the Coal Beds lately discovered there for and in behalf of the Hudsons Bay Company.

2 You will give due notice of that proceeding to the Masters of all vessels arriving there, and you will forbid all persons to work the Coal either directly by means of their own labour or indirectly through Indians or other parties employed for that purpose, except under the authority of a license from the Hudsons Bay Company.

INSPECTION OF COAL-MINES, 1923

The coal-producing areas of the Province are divided into the Coast District, which includes the Vancouver Island, the Nicola-Princeton, and the Telkwa coalfields, and the East Kootenay District.

COAST DISTRICT.

This district, comprising, as it does, the coalfields of Vancouver Island and the Coast as well as those of the Nicola and Similkameen valleys, has been subdivided, for inspection purposes, into three Inspection Districts.

Two of these Inspection Districts are on Vancouver Island, with headquarters for both at Nanaimo, which permits of one of the Inspectors being constantly at headquarters while the other is making inspections; it also permits of the interchanging of inspection duties so that each Inspector knows both districts.

The third district is the Nicola-Princeton Inspection District with headquarters at Merritt. In June, 1920, John G. Biggs was appointed to the inspectorate of this district.

NANAIMO INSPECTION DISTRICT.

HENRY DEVLIN, INSPECTOR (OFFICE, NANAIMO).

The Canadian Collieries (Dunsmuir), Limited—Nos. 1, 2, and 3 mines, all worked from what is known as the No. 1 tunnel, and No. 5 mine at South Wellington.

Granby Colliery No. 1 at Cassidy—3 slopes.

Pacific Coast Coal Mines, Limited—The Morden mine.

Nanoose Collieries, Limited—No. 1 mine.

Western Fuel Corporation of Canada (formerly Canadian Western Fuel Company)—Harewood, Reserve, and Wakesiah.

East Wellington Coal Company.

Adit mine, Old Wellington Colliery.

COMOX INSPECTION DISTRICT.

(INCLUDING NO. 1 AND PROTECTION SHAFTS, NANAIMO.)

THOMAS R. JACKSON, INSPECTOR (OFFICE, NANAIMO).

Western Fuel Corporation of Canada (formerly Canadian Western Fuel Company)—Protection and No. 1 mines.

The Canadian Collieries (Dunsmuir), Limited—Nos. 4 and 7 slopes and No. 5 shaft.

Pacific Coast Coal Mines, Limited—Suquash Colliery.

NORTHERN INSPECTION DISTRICT.

T. J. SHENTON, INSPECTOR (OFFICE, PRINCE RUPERT).

The Telkwa Collieries—Mine at Telkwa; and the Aveling Colliery, also on Telkwa river.

NICOLA-PRINCETON INSPECTION DISTRICT.

JOHN G. BIGGS, INSPECTOR (OFFICE, MERRITT).

The collieries operating during the year in this Inspection District, including the new mines that have been started, were:—

The Middlesboro Colliery of the Middlesboro Collieries, Limited, Merritt—Nos. 2, 3, 4, 5, 6, and 7 mines.

Fleming Coal Company.

Princeton Coal and Land Company's Princeton Colliery—No. 1 slope.

Coalmont Collieries.

Chu Chua Colliery.

EAST KOOTENAY DISTRICT.

The East Kootenay District is subdivided into two Inspection Districts—i.e., Northern Inspection District and Southern Inspection District. Both these districts are inspected by Robert Strachan as Senior Inspector, and John MacDonald, Inspector, with headquarters at the Mine-rescue Station at Fernie.

The collieries operating during the year were Coal Creek Collieries, Michel Colliery, and Corbin Colliery.

NANAIMO INSPECTION DISTRICT.

REPORT BY HENRY DEVLIN, INSPECTOR.

I have the honour to submit my annual report for the year ended December 31st, 1923, on the various coal-mines in my inspectorate, consisting of the Reserve, Harewood, and Wakesiah mines of the Western Fuel Corporation of Canada, Limited, Nanaimo (formerly Canadian Western Fuel Company); Nos. 1, 2, and 3 mines. Extension, and No. 5 mine, South Wellington, Wellington-Extension Colliery of the Canadian Collieries (Dunsmuir), Limited; Granby No. 1 Colliery of the Granby Consolidated Mining, Smelting, and Power Company, operating at Cassidy; Lantzville mine of the Nanoose-Wellington Collieries, operating at Nanoose; and the Old Wellington Colliery, Wellington, operated by King & Foster.

Western Fuel Corporation of Canada, Ltd.

Head Office—Nanaimo, B.C.

Capital, $1,500,000.

Officers.	*Address.*
H. J. McClung, President,	Flagstaff, Arizona.
G. W. Bowen, Vice-Chairman,	Nanaimo, B.C.
Mark Bate, Jr., Secretary-Treasurer,	Nanaimo, B.C.
John Hunt, General Superintendent,	Nanaimo, B.C.
Robert Laird, Mine Manager, No. 1 Mine,	Nanaimo, B.C.
Robert Henderson, Mine Manager, Reserve Mine,	Nanaimo, B.C.
Arthur Newbury, Harewood Mine,	Nanaimo, B.C.
William H. Moore, Wakesiah Mine,	Nanaimo, B.C.

The above company has operated the following collieries at Nanaimo during the past year, namely: No. 1 or Esplanade shaft, Nanaimo; Protection Island mine, Harewood, and Reserve.

The following returns show the combined output of all the company's mines for the past year:—

AGGREGATE RETURNS FROM WESTERN FUEL CORPORATION'S MINES FOR YEAR 1923.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	466,809			
" export to United States	68,624			
" " other countries				
Total sales		535,433		
Used in making coke				
Lost in washing	28,338			
Used under colliery boilers, etc.	84,194			
Total for colliery use		112,532		
Stocks on hand first of year	6,885			
" last of year	9,415			
Difference added to stock during year		2,530		
Output of colliery for year		650,495		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID ETC.

CHARACTER OF LABOUR.	UNDERGROUND		ABOVE GROUND		TOTALS	
	No. employed	Average Daily Wage	No. employed	Average Daily Wage	No. employed	Average Daily Wage
Supervision and clerical assistance	51		53		104	
Whites—Miners	482				482	
Miners' helpers						
Labourers	287		153		440	
Mechanics and skilled labour	140		96		236	
Boys	93		60		153	
Japanese			134		134	
Chinese						
Indians			2		2	
Totals	1,053		498		1,551	

REPORT BY THOS. R. JACKSON, INSPECTOR.

I have the honour to submit herewith my annual report for the year ended December 31st, 1923, on the various coal-mines in my inspectorate, consisting of No. 1, Protection, and Reserve mines belonging to the Western Fuel Corporation of Canada, Limited, Nanaimo; Granby No. 1 Colliery of the Granby Consolidated Mining, Smelting, and Power Company, operating at Cassidy; Comox mines, belonging to the Canadian Collieries (Dunsmuir), Limited, Nos. 4, 5, and 6, Cumberland; also Pacific Coast Coal Mines, Limited, Suquash Colliery.

NANAIMO COLLIERY.

No. 1 AND PROTECTION SHAFTS.

Robert Laird, Manager; Edward Courtney, Overman, Protection Mine. Robert Adam, Shift-boss; John Sutherland, Overman, No. 1 Shaft. Matthew Broderick, Shiftboss. William Johnson, John Hamilton, James McMeakin, James Dudley, Joe Dean, Thomas Blenkhorne, Joshua Norris, Thomas J. Woods, George Perry, Andy Bennett, George Moore, Neil McMillan, J. M. Brown, Wm. Bradley, Fred Nash, William Halliday, George Jardine, George R. Bradshaw, William Neave, Frank Green, John Weeks, Jack Devlin, Alex. Coombs, Andy Dean, and John Marrs, Firebosses.

No. 1 SHAFT, ESPLANADE.

This mine is situated at the south end of the Esplanade and adjacent to the bay shore-line. It is the oldest working-pit in Nanaimo district and has a large submarine area. The mine has three openings; two of them are in daily operation—namely, No. 1 and Protection shafts. The latter is situated on Protection Island. The third opening is Newcastle shaft. A ladder extends from top to bottom of this shaft, so that one can enter or leave the mine. It is used only for inspection and necessity; it also forms the exit for the return air of Newcastle airway. The men working in Protection are conveyed by scow to and from there. No. 1 shaft provides passage-way for the men employed in the South side of mine.

Firebosses and shotlighters use the Wolf safety lamp; other workmen use the Edison cap electric safety-lamp. Douglas and Newcastle seams are worked. On the South side of the mine Douglas seam is worked exclusively; on North side of mine coal is taken from both seams. In blasting nothing but permitted explosives are used and fired by cable and electric battery. Compressed air and electricity are used as motive power for haulage and drainage purposes. Hoisting-engines are driven by steam, so are the three Prescott pumps and main haulage-engine situated at the shaft-bottom.

The North side haulage system consists of heavy steel rails and copper trolley wire on the Main level, approximately 3 miles in length, extending from No. 1 shaft to the foot of Lamb's incline. The South side system consists of motor and direct haulage. Main and tail discontinued. The workmen are supplied with cars similar to North side of mine. The Diagonal engine picks up coal on the two Main slopes from four different points and delivers it in the shaft-bottom.

Development-work, South Side.

Drifting in No. 5 North was continued for a distance of 1,400 feet from the Main slope, when good coal was struck; 480 feet of this tunnel was driven through solid conglomerate with an average dip of about 14 per cent.

In No. 3 level, No. 3 dip has been reopened for a distance of 1,600 feet and development-work carried on the north side of the slope with very good results. Nos. 1 and 2 dips have also been developed and a large area of good coal found. At the top of No. 3 dip a shaft is being sunk to the Newcastle seam and is down within 15 feet of the coal. It is intended to fit this shaft with hoisting apparatus and carry on development-work in the seam before driving the Main tunnel.

Prospect-work is being carried on in No. 2 East area, off the main and tail roadway, where some good coal is expected to be recovered between the large faults, and also in the old workings at the bottom of the Diagonal slope.

Development-work, North Side.

The prospect known as No. 2 slope has been continued for a distance of 850 feet, but no coal has been seen in the last 300 feet, where a large down-throw fault was struck. The place going south off the slope is following a piece of coal 5 feet in thickness. Development is also being continued in No. 5 wall, where the Douglas seam is 2½ feet thick and is worked with Pick-quick mining-machines.

The old Motor level beyond Lamb's incline has now been reopened and heavy steel laid for 1,250 feet. It is the intention to run the motor to a point 2,000 feet beyond Lamb's and work the thin Douglas seam with Pick-quick machines from there to Newcastle shaft.

The reopening of Wilkinson's slope has been continued to No. 4 level and some very good coal found. In No. 15 South, No. 3 wall drifting has been carried on with good results. Nos. 1 and 2 inclines are also showing good. The old face-line has been reached and solid work is being continued in these areas.

Coal-dust.

The treatment of coal-dust has received considerable attention during the year. A large number of rock dust-barriers have been erected, especially in the South side. The main haulage-roads have been fitted with regular spraying systems and tanks are used in other sections where necessary. On the motor-roads the timbers and sides are cleaned by sweeping or the use of compressed air by means of hose-pipe and dust loaded out in cars.

In places where watering would injure the roads stone-dusting is done after the coal-dust has been loaded out. A heavy barricade of 12- by 12-inch timbers, in addition to the regular timbers, has been erected between the manway and the main haulage roadway. The electric cables are to be moved into the manway so as to minimize the danger should a trip break away on the slope.

North Side, No. 1 Shaft.

In the Douglas seam the work done is chiefly the extraction of pillars; the thickness of the seam varies from 3 to 7 feet. The Newcastle seam averages 3 feet in thickness and is worked by the long-wall system. Most of the output of coal is produced by mining-machines. The machines used are Pick-quick and Siskoll. Where the ground is faulty or the face is not extensive the mining is done by a Siskoll machine; where there is sufficient length of face to warrant it the Pick-quick machine is used. Both machines give good results. Compressed air is the motive power. Both machines undercut the coal to a depth of 6 feet, after which it is drilled and shot down. The brushing is taken off the floor to admit the car to the face; car carries about 16 cwt. of coal. Regulation size of place equals 12 yards with roadway in centre. Loaders load out the coal into cars. Eight loaders are supervised by one shotlighter, or fireboss. Four loaders are supervised by one faceman, who is a certificated miner. A loader does not need a miner's certificate to load coal. Portions of the long-wall face are worked by diggers.

At present coal from the pillars in the Douglas seam is being taken from the following sections of the North side of mine: No. 1 wall, No. 2 wall, Protection slope, and Lamb's incline, also Poverty row. Solid measures; the Douglas seam is being operated on the long-wall method in No. 5 wall. Mining-machines are used for undercutting the coal. A slope has been started to the dip of these workings to discover coal.

The ventilation of these districts is produced by a Guibal fan, 9 by 18 feet, rope-driven at 70 r.p.m., against a 2-inch water-gauge. The installation of a new fan is almost completed.

During my last visit of inspection I measured 45,740 cubic feet of air a minute passing up Protection Main slope, divided into four splits.

No. 1 Wall Split.—There was 10,040 cubic feet of air a minute passing for the use of thirty-three men and six mules. No gas found; sections fairly free from coal-dust and general conditions good.

No. 2 Wall Split.—There was 10,740 cubic feet of air a minute passing for the use of thirty-two men and seven mules. Found no gas; general conditions good. Parts of this section gather coal-dust and must be either loaded out and sent above ground or treated with water.

No. 3 Wall Split.—There was 11,700 cubic feet of air a minute passing for the use of sixty men and eight mules. General conditions good, got no gas and sections practically free from coal-dust.

Protection Pillar Split.—There was 9,000 cubic feet of air a minute passing for the use of thirty men and six mules. General conditions good; got no gas and sections fairly free from coal-dust.

I examined all report-books as required under section 91, subsections (4) and (26) of the "Coal-mines Regulation Act" and found them being complied with.

Burrell gas-detector tests show in the various return airways: No. 3 wall, 0.3 per cent. methane; Poverty row, 0.2 per cent. methane; No. 1 incline, 0.3 per cent. methane; No. 2 incline, 0.2½ per cent. methane.

South Side, No. 1 Shaft.

The workings are all in the Douglas seam and consist of pillar-and-stall work and extraction of pillars.

The ventilation is produced by a 72- by 180-inch double-inlet Sirocco fan, rope-driven, ratio 3.5 to 1, capable of producing 195,000 cubic feet of air a minute at a 4-inch water-gauge, driven by an engine of 350 horse-power. Another fan capable of producing the necessary ventilation of the mine stands ready to substitute should necessity require.

During my last visit I measured 37,920 cubic feet of air a minute passing down Main slope, divided into three splits.

Diagonal Split.—There was 13,740 cubic feet of air a minute passing for the use of thirty men and six horses. Ventilation, roadways, and timbering good. Found no explosive gas, but got an ⅛-inch gas-cap in Dawkin and Wilson's place. Coal-dust is water-treated and loaded out in cars and sent above ground occasionally, which makes the sections in fairly good condition.

No. 7 Split.—There was 7,740 cubic feet of air a minute passing for the use of sixteen men and three horses. Found no gas; section practically free from coal-dust and general conditions good.

No. 2 Dip Split.—There was 16,800 cubic feet of air a minute passing for the use of thirty-five men and five mules. Practically free from coal-dust owing to dampness. Got no gas and general conditions good.

Burrell gas-detector tests showed the percentage of methane in the return airways of this part of the mine as containing from nothing to 0.3 per cent. Sections of this part of the mine that have been sealed off by means of stoppings for gob-fires later have been reopened and worked to quite a degree of success.

The following are the official returns for the Nanaimo Colliery for the year ended December 31st, 1923:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	245,585			
" export to United States	36,102			
" " other countries				
Total sales		281,687		
Lost in washing	11,788			
Used under colliery boilers, etc	37,201			
Total for colliery use		48,989		
		330,676		
Stocks on hand first of year	6,388			
" last of year	7,324			
Difference added to stock during year		936		
Output of colliery for year		331,612		

Average Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	26		28		54	
Whites—Miners	210	7.44			210	
Miners' helpers						
Labourers	159	4.71 - 5.25	75	4.78 - 5.23	234	
Mechanics and skilled labour	96	5.25 - 5.92	47	5.32 - 6 58	143	
Boys	47	2.48 - 4.71	24	1.84 - 3.79	71	
Japanese						
Chinese			67	2.27 - 3.05	67	
Indians			1		1	
Totals	538		242		780	

RESERVE MINE.

Robert Henderson, Manager; Francis John, Overman; James McGrath and George Frater, Shiftbosses; James West, Albert Manifold, Joseph Thomson, Fred Bell, Richard Rallison, Ernest Kelly, John McCourt, J. Stobbart, Henry Allsopp, and William Neilson, Firebosses.

This mine is situated in the Cranberry district, about 5 miles south of Nanaimo. The coal is reached by two shafts at a depth of 950 feet, from which a rock tunnel 7 by 12 feet in section is driven across the measures on a 1-per-cent. grade a distance of 180 feet.

The seam worked in this mine is the Douglas, the thickness of which varies from 1 to 30 feet. The pitch varies from 10° to 50° and is generally dipping north or north-east. The coal is fairly hard, with a fairly good roof.

The seam is very much troubled with "folds" or "overlaps," which tend to make operations difficult. At times the seam pinches out and may be found under or over lapping.

All the coal mined in the mine is from No. 1 West heading, the East and West levels being finished. The heading is connected to No. 1 shaft 108 feet above the original shaft-bottom and forms the main haulage-road in the mine. Levels are being driven to the right and left off this heading, from which places are turned off.

The output of this mine is a little below last year owing to the seam pinching at different places.

The ventilation of the mine is produced by a pair of 20-inch Sirocco fans, connected to a 20- by 30-inch engine, rope-driven. On the engine is a drive-wheel 17 feet in diameter and on the fan-shaft a drive-wheel 5 feet in diameter. These fans, running with an engine-speed of 16 r.p.m., are capable of producing 140,000 cubic feet of air a minute, against a 3-inch water gauge.

The main haulage-road and working-places are very damp and practically no gas is found at any time in the workings. The mechanical haulage is all carried on by means of compressed air hoists, of which there are twelve in use.

The pillars have all been extracted from the East and West Main levels and also from the East side heading. Prospecting is being carried on to the right and left off No. 1 West heading. The Main heading and counter are up against the 300-foot barrier pillar of No. 5 mine and are standing in rock.

The Edison electric head-lights are being used in this mine and are giving good satisfaction, the Wolf type of safety-lamp is used only by the firebosses.

The surface plant consists of four return-tubular boilers, 16 by 24 inches, each 108 horse-power, with a steam-pressure of 125 lb.; one hoisting-engine, 20 by 60 inches, built by Barclay & Sons, Kilmarnock, Scotland. The drum is 12 feet in diameter and carries a 1¼ inch galvanized steel-wire rope. Hoisting-engines are fitted with an automatic overwinding device. One cross-compound Canadian Rand compressor with a capacity of 22,000 cubic feet of air a minute at 90 r.p.m.; one Ingersoll Rand compressor with a capacity of 22,000 cubic feet of air a minute, one 14- by 14-inch single engine built by Robert Armstrong, which supplies the light above and below ground, coupled by means of belt drive to d.c. generator, 220 volts, 120 amperes.

During the year one additional screen dumping-tipple with shakers and conveyors have been added, which makes the output easily handled and acts as spare in case of accident to the other. The coal is screened over 2-, 1½-, and ¾-inch screen, with nut and dross conveyors driven by a small compound engine.

During my last inspection visit to this mine I measured 20,000 cubic feet of air a minute passing up Main heading, divided into two splits.

No. 1 Split Section.—There was 18,000 cubic feet of air a minute passing for the use of forty-seven men and seven horses. General conditions good. Found no explosive gas but got ⅛-inch gas-cap at face of first left place off rock tunnel.

No. 2 Split Section.—There was 13,000 cubic feet of air a minute passing for the use of thirty-five men and six horses. General conditions good. Found no gas. All of these sections are more or less damp; some places wet, which makes the mine practically free from coal-dust.

Burrell gas-detector tests made in the two splits and Main return ventilating air-currents showed from nothing to 0.2 per cent. methane.

I regret to report that two fatal accidents occurred during the year, both due to a fall of rock on men engaged at the face of their working place.

The following are the official returns from the Reserve Colliery for the year ended December 31st, 1923:—

Sales and Output for Year	Coal		Coke	
(Tons of 2,240 lb.)	Tons	Tons	Tons	Tons
Sold for consumption in Canada	149,343			
" export to United States	21,935			
" " other countries				
Total sales		171,278		
Lost in washing	10,989			
Used under colliery boilers, etc.	28,881			
Total for colliery use		39,870		
		211,148		
Stocks on hand first of year	55			
" last of year	1,349			
Difference added to stock during year		1,294		
Output of colliery for year		212,602		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	15		13		28	
Whites—Miners	159	7.80			159	
Miners' helpers						
Labourers		4.71 - 5.25	47	4.78 - 5.25	124	
Mechanics and skilled labour	16	5.25 - 5.92	28	5.32 - 6.58	44	
Boys	35	2.48 - 4.71	24	1.84 - 3.05	59	
Japanese						
Chinese			45	2.27 - 3.05	45	
Indians			1		1	
Totals	302		158		460	

REPORT BY H. DEVLIN AND J. DICKSON, INSPECTORS.

WAKESIAH MINE.

William H. Moore, Manager; John Hynds, Overman; John F. Webber, G. G. Gray, S. K. Mottishaw, John Watson, Harry Carrol, and J. W. Shipley, Firebosses.

This mine is situated on the Western Fuel Corporation's farm, about 2 miles from Nanaimo, and is connected by railway with the Harewood branch line. Two shafts were sunk to a depth of 320 feet, at which the coal-measures are tilted and thrown up at varying angles and finally cut off by what is known locally as the "Little mountain."

About 700 feet from No. 2 shaft a pair of slopes have been driven, which cut the large fault to the south-east at 1,400 feet. New slopes have been driven to further exploit the measures to the south and east.

The pair of headings driven towards the Old Jingle Pot mine, after encountering many disturbances, at last got into an area of good coal which is now being exploited. The coal varies a great deal in thickness—namely, 2 to 20 feet. The floor is uniformly hard, but there is a very poor roof, which requires careful timbering. The coal itself is of very good quality and is somewhat friable, but is improving with depth. The contour of the field is very irregular, which makes haulage both difficult and costly. Haulage is carried on by means of four winches—three driven by compressed air and one by steam. During the year a new road was driven connecting the Main and New slopes with the Main level, and the coal hauled direct to the shaft-bottom by means of a second-motion 10- by 16-inch hoist, steam-driven.

The output from this mine is from 425 to 500 tons a day. A considerable amount of water has been encountered on the line of fault and is handled by nine pumps, of which eight are run by compressed air and one, a large Cameron at the shaft-bottom, by steam.

Ventilation is produced by means of a single-inlet Murphy fan. The mine is damp and free from coal-dust. Electric head-lamps of the Edison and Wheat types are in use and are proving satisfactory. The system inaugurated by the management last year of firebosses carrying two lamps—one an electric head-lamp for illuminating purposes and a Wolf safety-lamp with the light set low for gas-testing—is still being carried out. No other safety-lamps are in use in the mine.

Another compressor is being installed to provide more power for further development. Two more boilers have been added during the year, making four boilers, of which three are in operation at one time. The total capacity is 700 horse-power. Coal is being hoisted from No. 2 shaft by a 14- by 16-inch first-motion engine.

A Pick-quick mining machine is in use and another is being installed shortly. Another pair of slopes are being driven, which will shorten the haulage considerably.

A larger generator has been installed and the shaft-bottom stables and Main level lighted by electricity. Larger air-lines have been installed to provide for greater volumes of compressed air to supply power to the new machinery installed and contemplated.

Cassidy Collieries, Grundy & M. S. & P. Co.—Boarding House

Cassidy Collieries, Grundy & M. S. & P. Co.—Office

The outstanding event of the year has been the installation of a Mavor & Coulson shaker conveyor system and a M. & C. gate-end loader, which is now in daily use between Nos. 3 and 4 Left levels, New slope. The conveyors are coupled direct to a M. & C. engine, while the gate-end loader is driven by a M. & C. turbine, chain-driven. This was a pronounced success from the start. The conveyors are about 105 yards long and are carrying from 150 to 200 tons a shift, and are easily capable of handling much larger amounts if necessary. The gate-end loader is capable of handling a ton a minute if necessity requires it.

This is the only operation of its kind in British Columbia and the Western Fuel Corporation has shown commendable foresight in overcoming the problems connected with the exploitation of small seams; the immediate result of which will be the rapid installation of other machines of the same type, both in this mine and other mines of the same corporation. The net result will undoubtedly greatly extend the life of the Nanaimo coalfields.

There has been no serious accident reported from this mine during the year, notwithstanding the frail roof conditions, largely owing to the systematic manner in which the timbering is carried on and the efforts of the management along safety-first lines.

The mine is still being developed steadily, especially in the Slope section, and a large area is being opened out with the intention of working it solely by the conveyor-loader system.

During the December inspection of this mine there was 32,400 cubic feet of air a minute passing in the Main intake, divided into two splits.

No. 1 split was passing 15,000 cubic feet a minute for the use of sixty-seven men and six horses, and the Burrell gas-tester showed 0.3 per cent. CH_4 in the return air.

No. 2 split was passing 13,200 cubic feet of air a minute for the use of forty-five men and five horses, and the Burrell gas-tester showed 0.1 per cent. CH_4 in the return air.

A small quantity of explosive gas was found in a roof cavity in one of the working-places. The working-places and roadways were well timbered and in good condition.

The following are the official returns from the Wakesiah Colliery for the year ended December 31st, 1923:—

Sales and Output for Year.	Coal		Coke	
(Tons of 2,240 lb.)	Tons	Tons	Tons	Tons
Sold for consumption in Canada	70,728			
" export to United States	10,398			
" " other countries				
Total sales		81,126		
Lost in washing	5,561			
Used under colliery boilers, etc.	17,012			
Total for colliery use		22,573		
		103,699		
Stocks on hand first of year	442			
" last of year	742			
Difference added to stock during year		300		
Output of colliery for year		103,999		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	7		9		16	
Whites—Miners	96	7.60			96	
Miners' helpers						
Labourers	46	4.71-5.25	29	4.78-5.23	75	
Mechanics and skilled labour	27	5.25-5.92	19	5.32-6.58	46	
Boys	11	2.48-4.71	10	1 84-3.05	21	
Japanese						
Chinese			16	2.27-3.05	16	
Indians						
Total	187		83		270	

HAREWOOD MINE.

This mine was abandoned during the month of January, 1923, and has not since been worked, so that only a small output was made during the year 1923, the official returns for which are appended.

The following are the official returns from the Harewood Colliery for the year ended December 31st, 1923:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Total of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	1,153			
" export to United States	169			
" " other countries				
Total sales		1,322		
Used in making coke,				
Used under colliery boilers, etc.	1,100			
Total for colliery use		1,100		
		2,422		
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		2,422		

AVERAGE NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID ETC.

Character of Labour	Underground		Above Ground		Totals	
	No. employed	Average Daily Wage	No. employed	Average Daily Wage	No. employed	Average Daily Wage
		$		$		$
Supervision and clerical assistance	3		3		6	
Whites—Miners	17	12 13			17	
Miners' helpers						
Labourers	5	4 71 5 25	2	4 78	7	
Mechanics and skilled labour	1	5 25	2	2 25	3	
Boys			2	6 20	2	
Japanese						
Chinese			6	2 88	6	
Indians						
Totals	26		15		41	

REPORT BY H. DEVLIN AND J. DICKSON, INSPECTORS.

The Nanoose-Wellington Collieries Co., Ltd.

Head Office—Lantzville, B.C.

Capital, $2,000,000.

Officers.	*Address.*
J. A. Coleman, President and Managing Director,	Seattle, Wash.
Russel H. Phinney, Secretary,	St. Paul, Minn.
N. B. Roy, Assistant Secretary,	Lantzville, B.C.
M. N. Olsen, Treasurer,	Lantzville, B.C.
James W. Jemson, Superintendent,	Lantzville, B.C.

Value of plant, $325,112.

LANTZVILLE MINE.

Jas. W. Jemson, Mine Manager; Jos. Neen, Overman; H. M. Davidson, A. Derbyshire, J. Michek, C. Simister, D. W. Thomas, J. Handlen, and P. Hindmarch, Firebosses.

This mine is situated at the entrance of Nanoose bay, about 9½ miles north of Nanaimo. The seam worked is known as the Old Wellington, which varies considerably in thickness and is much disturbed by faults. The seam is in several benches, the coal and rock partings varying in thickness. The uniform part of the seam is the bottom coal, which averages 23 inches. The best coal area has been found near the shore-line, but unfortunately, after going through a fault about 700 feet from the shore-line, the seam pitched gradually, reducing the cover overhead to make mining of submarine area practically impossible, but probably as the mine extends eastward there will be sufficient cover to mine coal in submarine areas, of which there is a large area untouched and unexplored.

It is proposed in the spring to put down a few boreholes to prove the strata and coal beds. The present working seam is reached by a shaft 8 by 16 at a depth of 173 feet; also a rock drift. The shaft is the downcast and the tunnel is the fan-drift, which is also used as an exit for men and horses.

The mine is well ventilated and very little gas has been found. The ventilator or fan is a Keith 00, capable of producing 80,000 cubic feet a minute. The water-gauge at the fan is 0.9 inch. The air-current is divided into two splits. The system of working is practically pillar and stall, with small sections of long-wall. The roof is generally good, being sandstone and hard sandy shale. Prop and cap-piece is generally sufficient for all purposes. Each fireboss in turn takes the Burrell gas-detector into his section and tests for lower percentages of gas than the ordinary safety-lamp will detect, and reports his findings in the report-book.

A main and tail haulage system has been completed and seems to be very satisfactory. During the year a new shaker screen has been installed, which distributes the coal from the tipple and facilitates the work of preparation.

One of the small cottages near the mine has been converted into a mine-rescue and first-aid station. Two of the rooms are devoted to the visiting doctor's requirements and the residents of the village meet the doctor at an appointed time.

First-aid classes are being inaugurated and a large attendance is expected. This mine has been free from serious accidents and received the congratulations of the Hon. William Sloan, Minister of Mines, for the freedom from fatal accidents during the year 1923 and preceding years.

During the last inspection in December there was 31,300 cubic feet of air passing in the main intake, dividing into two splits.

No. 1 split was passing 12,000 cubic feet of air a minute for use of thirty-five men and five horses.

No. 2 split was passing 15,000 cubic feet of air a minute for the use of sixty-three men and seven horses.

The working-places and roadways were well timbered and in good condition. No gas was found in this mine.

The following are the official returns from the Lantzville Colliery for the year ended December 31st, 1923:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	56,230			
" export to United States	9,634			
" " other countries				
Total sales		65,864		
Used in making coke				
Lost in washing	13,423			
Used under colliery boilers, etc.	7,698			
Total for colliery use		21,121		
		86,985		
Stocks on hand first of year	2,415			
" last of year	1,368			
Difference taken from stock during year		1,047		
Output of colliery for year		85,938		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	11	6.11	8	5.12	19	5.70
Whites—Miners	115	6.09			115	6.09
Miners' helpers	49	5.00			49	5.00
Labourers	28	4.69	13	4.78	41	4.47
Mechanics and skilled labour	6	5.25	25	5.34	31	5.33
Boys	15	3.38	2	2.69	17	3.14
Japanese						
Chinese			18	2.87	18	2.87
Indians						
Totals	224	5.47	66	4.30	290	5.19

Name of seams or pits—Lantzville mine, Wellington seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—One hoisting shaft; one tunnel, which acts as fan-drift; five levels. Seam—Sandstone roof, 1 foot cap-rock, 14 inches coal, 18 inches shale, 1 foot coal, 6 inches shale, 20 inches coal.

Description and length of tramway, plant, etc.—Plant described in Minister of Mines previous reports. Length of tramways: Main level, 2,500 feet; No. 2 West level, 1,000 feet; No. 3 East level, 1,400 feet; No. 3 West level, 700 feet; Main slope, 1,800 feet; No. 1 slope, 800 feet; No. 2 slope, 1,150 feet; track in working places, etc., approximately 13,500 feet; a total of approximately 4½ miles.

REPORT BY THOS. R. JACKSON

Granby Consolidated Mining, Smelting and Power Co. Colliery at Cassidy

Officers.	*Address.*
J. T. Crabbs, President.	25 Broadway, New York.
H. S. Munroe, Vice-President and General Manager.	Anyox, B.C.
Edward Everett, Secretary.	25 Broadway, New York.
Valentine Quinn, Treasurer.	813 Birks Bldg., Vancouver.
C. M. Campbell, Superintendent.	Cassidy, B.C.

GRANBY No. 1 COLLIERY.

Charles Campbell, Resident Superintendent; James B. Toubey, Manager; William P. Toubey, Overman; Albert Radford, Hugh Clarkson, Matthew Meek, Alexander McLaughlin, John Wright, Joe Lavin, Owen Dabb, John Bennett, J. W. Smith, and Wm. Armison, Firebosses.

This mine is situated at Cassidy, some 10 or 11 miles in a southerly course from Nanaimo. The Douglas seam is worked; its average thickness is about 10 feet. Underground development continues in addition to extraction of pillars in certain sections of both north and south side of the Main slope. The Main slope is now fully a mile from the surface.

The coal hoisted during the year amounted to 228,534 tons. Of this, 39,435 tons, or 17.3 per cent., was lump. The balance, after deductions were made for power and household purposes, was treated in the washery and sold either as pea and slack coal or as nut coal. In addition to the above, 29,706 tons of rock was hoisted. Much additional rock was also stowed away below.

Tonnage showed an appreciable reduction from the previous years. This was due to more extensive use of fuel-oil and the increased competition from Utah coal in the American market made possible largely by duty levied by the United States Government on Canadian coal entering the States. A mild fall and winter also reduced the demand to some extent.

During the year some slight changes were made in the washery and a large section of the refuse-bank was retreated and a low-grade product produced, which was sold. There was no new construction during the year.

The chief feature of the underground work was the occurrence of blow-outs. These still continue, but there are not now so many, mainly because the area in which they are prevalent has not been worked to the same extent. Pilot holes still continue to be bored ahead, but so far we have no record of an instance where they have indicated the existence of a pocket of gas under pressure.

Safety-first equipment was maintained and improved during the year. All travelling-ways are now treated with a generous application of non-explosive dust. Dust barriers have also been erected at many places in the mine.

Owing to the blow-outs occurring in the deep workings of the mine the use of explosives was prohibited except under certain conditions. With respect to the workmen's method of retreat either immediately preceding a blow-out or following one, the following system has been

adopted, which, so far, has proved fairly satisfactory: By a system of signalling by pull-bells (no electric bells are allowed in the affected area) all men are quickly notified of a blow-out, and they are daily instructed to get to fresh air by the nearest route. Firebosses have small districts and are enabled to get to an outburst within a few minutes of its occurrence. Miners are constantly warned to get back from the face at the least sign of warning. A great deal depends on the miners themselves, and they are in most cases very careful, although some of them do take chances owing to familiarity with the danger.

The management is fully alive to the dangerous condition that exists after a blow-out, and very careful inspections are made before the miners are allowed to go to work.

Edison electric safety-lamps are used by all workmen except the firebosses, who use the Wolf type of safety-lamp for testing for methane.

Mine Development.—Two tunnels have been driven in rock about 1,300 feet, with the necessary crosscuts. These tunnels are expected to open up a large area of good coal, from which we are at present cut off by a geological intrusion. The tunnels are 9 by 6 feet in the clear; one pitching 14°, the other 11°.

An incline has been driven up from No. 2 level to within 45 feet of the surface. At a point near the face of this heading a small shaft has been started from the surface. The purpose of this shaft and heading being to flush the washery refuse into the old workings by means of flumes, and so on, with the double object of completely filling up solid all old workings in the mine, thus eliminating the danger from fire by spontaneous combustion, and effectively filling up all the old caves in pillar-workings and preventing any possible accumulations of gas at these points. It will also facilitate the complete removal of pillar coal without the danger of surface subsidence; also shorten the distance the ventilation must travel in order to keep old workings clear and in good shape.

Safety Measures.—In addition to our automatic fog sprays on the Main slope, a radiator installed at the entrance to the manway, consisting of eight pipes 4 inches by 20 feet, with 100 feet of 4-inch drain-pipe leading down the manway, has the effect of raising the temperature of the intake air from 11° to 14° above the outside temperature. This prevents the drying-out of the mine, and the exhaust steam, being discharged into the manway at this point, saturates the air, causing moisture to be deposited as it travels through the mine.

The haulage is so arranged that the visibility due to the exhaust steam is in no way interfered with. All main landings are kept whitewashed and electric lights installed, thus eliminating the danger of poor light.

During my last inspection of this mine I measured 123,320 cubic feet of air a minute passing into the mine, divided into three splits.

In No. 4 North level split there was 16,200 cubic feet of air a minute passing for the use of forty-five men.

In No. 7 North level split there was 33,940 cubic feet of air a minute passing for the use of forty-eight men.

In No. 7 South level split there was 12,144 cubic feet of air a minute passing for the use of twenty-four men.

I found explosive gas at face of No. 4 North level. Quantity sufficient to warrant withdrawal of men at face. Place to be fenced off until gas is removed. Other conditions, such as timbering and roadways, etc., were generally good.

In the matter of treating coal-dust the upper sections of both north and south side of Main slope are fairly free owing to the roadways being a little damp.

In the lower levels where coal-dust would gather it is liberally treated with non-explosive dust, and when necessary the mixture is loaded out.

Burrell gas-detector tests:—Main return at fan: Quantity of air, 130,000 cubic feet; methane, 0.5 per cent. Main South side: Quantity of air, 35,878 cubic feet; methane, 0.1 per cent. Main North side: Quantity of air, 92,670 cubic feet; methane, 0.3 per cent. No. 6 North split: Quantity of air: 16,380 cubic feet; methane, 0.5 per cent. No. 7 North split: Quantity of air, 18,000 cubic feet; methane, 0.7 per cent.

I examined all report-books as required under section 91, subsections (4) and (36), of the "Coal-mines Regulation Act" and found them being complied with.

There was one fatal and one serious accident occurred at this mine during the year. The fatal was due to haulage.

The following are the official returns for the Granby Colliery for the year ended December 31st, 1923:—

SALES AND OUTPUT FOR YEAR	COAL		COKE	
(Tons of 2,240 lb.)	Tons	Tons	Tons	Tons
Sold for consumption in Canada	150,602			
" export to United States	28,408			
" " other countries				
Total sales		179,010		
Lost in washing	24,630			
Used under colliery boilers, etc	24,056			
Total for colliery use		48,686		
		227,696		
Stocks on hand first of year	1,111			
" last of year	1,949			
Difference added to stock during year		838		
Output of colliery for year		228,534		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND		ABOVE GROUND		TOTALS	
	No. employed	Average Daily Wage	No. employed	Average Daily Wage	No. employed	Average Daily Wage
		$		$		$
Supervision and clerical assistance	12	9 61	11	3 45	23	6 59
Whites—Miners	201	7 36	....	....	201	7 36
Miners' helpers	....	....	....	....	....	....
Labourers	....	....	88	4 09	88	4 09
Mechanics & skilled labour	89	4 97	38	5 71	127	5 18
Boys	....	....	....	....	....	....
Japanese	....	....	....	....	....	....
Chinese	....	....	....	....	....	....
Indians	....	....	....	....	....	....
Totals	302	6 74	137	4 65	439	6 03

Name of seams or pits—Granby Colliery No. 1, Douglas seam

Description of seams, tunnels, levels, shafts, etc., and number of same—Douglas seam. Average dip, 20°. Seam irregular in thickness, varying from 0 to 25 feet sometimes in remarkably short distances. Seam subject to rolls, pinched and slitted areas. The mine is being operated with the idea of extracting largest possible percentage of coal at minimum cost. Large and substantial pillars have been left along all main haulage roads and permanent airways. The Main slope has been driven approximately 5,000 feet from the surface, is exceptionally well timbered, and has been driven wide enough for two tracks. Seven levels have been turned to north and south off Main slope. Practically all coal extracted to date has come from development places.

Description and length of tramway, plant, etc.—Plant is modern in every way. Sirocco fan, capacity 150,000 cubic feet a minute; Vulcan hoist, 18 by 36 inches, double-drum second motion. Edison storage-battery locomotives used for underground haulage in part of the mine; remainder by main and tail air-hoists. No mules or horses used underground. The tipple is equipped with rotary dump, Marcus screen, and loading booms. Railway cars handled with Fairmont car-retarders. The washery is equipped with Hummer screen, 2-compartment jigs, nine Deister-Overstrom coal-tables, 75-foot Dorr thickener, flotation cells, and Oliver

filter. Boiler plant is equipped with two Badenhausen boilers fired by Combustion Engineering Corporation type E stokers, and one B. & W. boiler fired with Sanford-Riley mechanical stoker. Ashes flumed to dump. Power plant includes two compressors, generators, and cooling-pond.

REPORT BY H. DEVLIN AND J. DICKSON, INSPECTORS.

King & Foster.

Head Office—Herald Building, Nanaimo, B.C.

Officers.	*Address.*
A. G. King, Jr., Partner.	Box 655, Nanaimo, B.C.
E. R. Foster, Partner.	
A. G. King, General Manager.	

Nos. 2, 4, AND 5 MINES.

J. Ovington, Overman; H. Shepherd and J. Saunders, Firebosses.

These mines are operated by the King & Foster Company under a lease from the Canadian Collieries (Dunsmuir), Limited, and are extracting the coal which was left near the outcrop of the Wellington seam when mining in this area was abandoned by the Wellington Colliery Company.

The mines are all worked from surface outcrops and are of small extent, with numerous "breaks" to the surface. The coal is from 2 to 6 feet thick and is of excellent quality; both long-wall and pillar-and-stall methods of mining are applied, according to local conditions.

The mines are adequately ventilated by natural means and no inflammable gas has been found. There were seventeen men employed underground at the time of the last inspection in December.

The screening and loading plant is situated at the railway near Wellington, about a mile from the mines. The coal is hauled between these points by a gasolene-locomotive running on narrow-gauge track.

The following returns show the output of the firm's mine for the year 1923:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	11,040			
" export to United States	*Nil*			
" " other countries	*Nil*			
Total sales		11,040		
Used in making coke				
" under colliery boilers, etc	32			
Total for colliery use		32		
		11,072		
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		11,072		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR	UNDERGROUND		ABOVE GROUND		TOTAL	
	Number employed	Average daily wage	Number employed	Average daily wage	Number employed	Average daily wage
		$		$		$
Supervision and clerical assistance	3	6 13			3	6 13
Whites—Miners	18	5 89			18	5 89
Miners' helpers	11	4 62			11	4 62
Labourers			7	4 13	7	4 13
Mechanics and skilled labour			4	5 25	4	5 25
Boys			1	2 00	1	2 00
Japanese						
Chinese						
Indians						
Totals	32		12		44	

Name of seams or pits—Wellington seam (Old Adit and No. 1 slope), Upper seam.
Description of seams, tunnels, levels, shafts, etc., and number of same—Three slopes.
Description and length of tramway, plant, etc.—Tramway 7,000 feet long; loading-chutes; one gasolene-locomotive; one 12-horse-power hoist and boiler; one Keith fan and gas-engine (5 horse-power); one 25 horse-power gasolene-engine, shaker, and rotary screen.

REPORT BY H. DEVLIN AND J. DICKSON, INSPECTORS.

East Wellington Coal Company

Officers.	*Address.*
H. W. Maynard, President.	P.O. Box 623, Nanaimo, B.C.
J. J. Grant, Vice-President.	P.O. Box 965, Nanaimo, B.C.
Wm. Warner, Secretary.	413 Granville Street, Vancouver, B.C.
P. S. Fagan, Treasurer.	P.O. Box 1588, Victoria, B.C.

EAST WELLINGTON COLLIERY

Wm. Roper, Mine Manager; E. H. Devlin, D. McMillan, D. Morgan, and G. Dow, [illegible] Foremen.

The mine reached the Wellington seams in the month of April by means of two slopes from the surface and the seams have been steadily developed continuously since that time. At the end of the year the mine was capable of producing 300 tons a day.

The Main slope is 1,135 feet in length, 6 by 12 feet in the clear, and dips 25° 41'; the vertical cover being 488 feet where the seam was reached.

After considerable prospecting in the Upper seam a short slope was driven in the Lower seam, some 25 feet below, and the present development is in this Lower seam.

Most of the output is mined by a Sullivan chain-machine and the greater part of the mine is worked on the long-wall system. The plant consists of three horizontal tube-boilers having 12- by 16-inch coupled engine geared to a 5-foot diameter drum.

The mine is ventilated by a Sheldon fan and the water-gauge at present is 1.75 inches. The machine-shop is fully equipped for the present requirements of the colliery. The Eclipse and Wheat lamps are used by the men underground.

During my last inspection in December there was [illegible] cubic feet of air a minute passing for the use of fifty-one men and three horses. Explosive gas was found in two places during this inspection.

The following are the official returns for the East Wellington Colliery for the year ended December 31st, 1923:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	25,700			
" export to United States				
" " other countries				
Total sales		25,700		
Used in making coke				
" under colliery boilers, etc.	2,505			
Total for colliery use		2,505		
		28,205		
Stocks on hand first of year	*Nil*			
" last of year	481			
Difference added to stock during the year		481		
Output of colliery for year		28,686		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	5	6.99	1	6.66	6	6.87
Whites—Miners	78	5.70			78	5.70
Miners' helpers						
Labourers	13	4.85	5	5.03	18	4.90
Mechanics and skilled labour	5	5.49	9	5.36	14	5.40
Boys	4	2.77	6	1.83	10	2.20
Japanese						
Chinese	1	2.75	20	2.81	21	2.81
Indians						
Totals						

Name of seams or pits—Old Wellington seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—Two slopes, 25°, 1,135 feet long, 6 by 12 in the clear.

Description and length of tramway, plant, etc.—1,400 feet of tramways to coal-seam and 3,600 feet throughout the mine; one hoisting-engine, 12 by 16, 5-foot drum; tipple, screens, and picking-table; five winches below ground; one Sullivan coal chain cutter; two compressors, capacity 1,250 feet; one Sheldon fan, 6,800 feet capacity; one 6- and one 10-kw. electric-lighting sets; complete outfit of electric mine-lamps and charging equipment and fully equipped blacksmith and machine shops, etc.; three horizontal return-tube boilers, 450 horse-power.

Canadian Collieries (Dunsmuir), Ltd.

Head Office—Montreal, Que.

Capital, $15,000,000.

Officers.	*Address.*
F. Perry, President,	Montreal, Que.
H. B. Walker, Vice-President,	Montreal, Que.
H. S. Adlington, Secretary-Treasurer,	Montreal, Que.
P. S. Fagan, Assistant Secretary,	Victoria, B.C.
Chas. A. Villiers, General Manager,	Victoria, B.C.
Thos. Graham, General Superintendent,	Cumberland, B.C.

The Canadian Collieries (Dunsmuir), Limited, in 1910 acquired all the holdings of the Wellington Colliery Company, Limited, and since then has been operating the following mines:—

The Extension Colliery, in the Cranberry District (Extension), T. A. Spruston, manager.

The Comox Colliery, in the Comox District; Charles Graham, district superintendent, William Walker, John L. Williams, J. G. Quinn, managers at the several mines.

The following table shows the combined output of all this company's collieries during the past year:—

AGGREGATE RETURNS FROM THE CANADIAN COLLIERIES (D.) LTD. MINES FOR YEAR 1923.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	378,381			
" export to United States	49,787			
" other countries				
Total sales		428,168		
Lost in washing	116,136			
Used in making coke				
" under colliery boilers, etc.	22,936			
Total for colliery use		139,092		
		567,260		
Stocks on hand first of year	9,382			
" last of year	1,260			
Difference added to stock during year		2,678		
Output of colliery for year		569,938		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	88		44		132	
Whites—Miners	525				525	
Miners' helpers	14				14	
Labourers	161		38		199	
Mechanics and skilled labour	131		144		275	
Boys			38		38	
Japanese and Chinese—Miners	119				119	
Helpers	99				99	
Labourers	66		81		147	
Totals	1,203		345		1,548	

REPORT BY H. DEVLIN AND J. DICKSON, INSPECTORS.

WELLLINGTON EXTENSION COLLIERY.

Thomas A. Spruston, Superintendent; James Strang, Manager, Nos. 1, 2, 3, and 6 Mines, Extension; William Wilson, Manager, No. 5 Mine, South Wellington.

This colliery, operated by the Canadian Collieries (Dunsmuir), Limited, is composed of Nos. 1, 2, 3, and 6 mines at Extension and No. 5 mine at South Wellington, all situated in the Cranberry district. The Extension mines are connected to Ladysmith, on Oyster harbour, by the Wellington Colliery railway, 11 miles long, over which the entire output from these mines is hauled for shipment.

The No. 5 mine is situated at South Wellington, about 9 miles from Ladysmith, the output being hauled over the Esquimalt & Nanaimo Railway to the shipping-point, Ladysmith, where it is either loaded in vessels or taken to Mainland points by transfer-barge in railway-cars. The coal is a very high-grade domestic fuel and is in great demand in the Coast cities.

The Nos. 1, 2, 3, and 6 mines are opened up in the Wellington seam, which varies in thickness from 2 to 6 feet. The major portion of the seam being worked at present is very much disturbed and dislocated by "folds," "steps," and "barren ground." In some of these "wants" or barren patches silt-fills have taken the place of the coal, while in others the roof and floor have met, completely "pinching" the coal out. These "wants" vary from 50 to 500 feet in extent.

The Nos. 1, 2, and 3 mines, which were originally opened up by separate slopes on the outcrop of the seam, are now connected by a rock tunnel driven 14 by 7 feet in the clear on a 1-per-cent. grade, and a little over a mile in length, to the intersection of the Nos. 2 and 3 mines, and tapping the No. 1 mine at a distance of three-quarters of a mile from the surface. Electric-motor haulage is maintained along the tunnel and continues into No. 2 mine, a distance of 1¼ miles, and half a mile into No. 3 mine. The underground employees are taken to and from their work in each respective mine along this tunnel by means of a "riding-trip" of cars hauled by a 13-ton Baldwin-Westinghouse electric locomotive.

The No. 6 mine is opened up on the Wellington seam, about 1¼ miles to the north-west of the Main tunnel, and connected to the tipple by a narrow-gauge railway about 1 mile in extent, which is operated by a 5-ton General Electric haulage-locomotive. A gravity-incline 3,000 feet long connects this railway up with the mine.

POWER-HOUSE.

The boiler plant consists of four Goldie & McCulloch return-tubular boilers of 163-horse-power capacity each. Electric power is supplied by three 250-volt d.c. generators. No. 1 is a Cracken-Wheeler generator of 112.5-kw. capacity, direct-coupled to a 15 by 14 Ideal engine; No. 2 is a Westinghouse 150-kw. capacity, connected direct to a Fleming-Harrisburg compound engine, size 14 by 14 by 32; and No. 3 is a General Electric 150-kw. capacity, direct-connected to a 16 by 16 Robb-Armstrong engine. A Blake fire and supply pump, 12 by 8 by 10, is maintained in good order in the boiler-house.

TIPPLE.

The mine-cars are handled over a Phillips crossover dump, which is cut off and fed to the dump by means of a steam-ram. The coal is dumped over a bar-screen chute on to a perforated shaker screen, which in turn feeds the coal to a 50-foot picking-table. An elevated rock-dump 160 feet in height is used in conjunction with the tipple, with a self-dumping skip operated by a 100-horse-power Ottumwa steam-driven hoist. The usual repair-shops for underground service are in close proximity to the tipple, consisting of machine, blacksmith, car-repair, and electric shops, with standard mine-gauge tracks running into each of them. There is also a railway-car repair and carpenter shop equipped with rip-saw, band-saw, circular, boring-machine, and lathes.

THE WASH-HOUSE.

The main building is 120 by 40 feet and consists of four separated changing-compartments, providing 100 lockers to each compartment. The bath-room is situated in the centre of the building, giving easy access to the four compartments, and consists of thirty-six spray-baths and eight hot- and cold-water taps over a 3- by 30-foot bench containing wash-basins. A dry-room is provided for extra-wet clothes; here the men may turn their wet garments over to the

attendant and have them thoroughly dried for the next day. Two large rooms with lockers and shower-baths are attached to the main building, providing ample room for the firebosses and officials. A landing-platform, 120 by 40 feet, is laid along the front of the washhouse where the workmen's train arrives, thus giving ample room to the men in getting on and off the train.

FIRST-AID AND MINE-RESCUE TRAINING

During the year first-aid and mine-rescue classes have been maintained and the following number passed examinations and received certificates: First year, 25; second year, 9; third year, 3; fourth year, 7; total passed examinations during the year, 44. Total certificated men in the Wellington Colliery, 170. Fourteen men took the mine-rescue training during the year, eleven of whom were granted certificates; the remaining three were qualified but indisposed at the time of examination. Total certificated mine-rescue men in the colliery, 54. A competent staff of first-aid men is always on hand ready for any emergency.

A modern ambulance (railway) car supplied with steam heat, hot and cold water, and fitted with bed, blankets, sterilizing outfit, and an adequate amount of bandages, splints, and the regular first-aid material, is constantly maintained in readiness within a short distance from the mine entrance. There is also fitted up first-aid rooms at Extension and South Wellington, with all the necessary equipment to provide for any emergency.

Rescue-training is carried out in an imitation mine-gallery which is maintained on the mine plant, with all the equipment that goes to make up the timbered roadways, cuts, overcasts, and smoke-chamber. Bench-work is carried out in a separate building. The equipment consists of six 2-hour sets of the "Paul" breathing apparatus, one oxygen-pump, six oxygen tanks, one pulmotor, and safety-lamps of the Wolf and Edison types.

LADYSMITH.

The shipping-point for the output of this colliery is at Ladysmith, where the coal is either shipped by vessel or railway-car by means of transfer barge to the Mainland points.

The coal-washery is also situated at this point and consists of three washers of the following dimensions: Nos. 1 and 2, diameter 8 feet 9 inches; No. 3, diameter 8 feet 3 inches, depth 3 feet 9 inches; computed capacity of each washer, 200 tons for twelve hours. Six compartment jiggs are situated on the lower floor and three Massco tables, 14 by 7 feet, which take care of the finer grades of coal, which produces a high-grade coal for steam, coking purposes, and foundry use.

Power for the washery is supplied by a Pelton wheel which is operated from the mountain water source. A 40-kw., 240-volt Allis-Chalmers Bullock generator supplies power for lighting purposes in and around the washery, shipping, and wharves.

DIAMOND-DRILLING

Diamond-drilling has been carried out continuously during the year 1923, with the exception of a few weeks' cessation between September and November. Four holes have been completed and another commenced—one in the Bright district and three in the Cranberry district—covering a total of 1,301 feet 9 inches of diamond-drilling for the year 1923.

PROSPECTING

During the year extensive prospecting has been carried out on the south-eastern extremities of the Haslam flats, Cranberry and Bright districts.

SAFETY-FIRST WORK

The company has a permanent safety engineer who visits at least once a month all the mines, surface, railway, washery, and wharves. The company also has an agreement with the underground employees to appoint a competent safety inspector from amongst themselves and who is paid by the company, to make an inspection of each mine at least every two weeks. It is gratifying to know that through the combined forces at work in this direction the results obtained again in the year 1923, having no fatal accidents, are very commendable and warrant a continuation of "safety-first" methods for the prevention of accidents in and around the mines.

No. 1 Mine, Extension.

James Strang, Manager; Thomas Wilson, Overman; James Glen, John Greenhorn, David Gordon, John Mawson, Alex. Orr, William Bauld, and John Chester, Firebosses.

This mine is entered three-quarters of a mile along the Main tunnel and is operating in what is known as the "Underlap" portion of the Wellington seam, which is very irregular in thickness and very much troubled with "folds," small faults, and "pinch-outs" or "wants." The method of mining is the long-wall system; owing to the broken and dislocated conditions of the field, hand-mining is employed.

The development during the year has been concentrated on the West Incline and No. 6 East sections. The West Incline section: The incline was driven through the old workings that were abandoned some fifteen years ago for the purpose of recovering an area of coal that is lying between a down-throw fault and the outcrop of the seam and which cut off the old workings. The long-wall face, which is some 350 feet in extent, has an average showing of 4 feet of good coal. The No. 6 East section: This section is operated on the long-wall method, but is very much disturbed by "rolls" and "pinch-outs." Some pillar-extraction is being carried out in the Nos. 2 and 3 Slope districts. The haulage equipment consists of 100-horse-power Ottumwa electric-driven hoist situated at the top of the Main slope. Owing to the undulating ground in the No. 6 East section it is necessary to maintain a small 50-horse-power electric-driven hoist for haulage purposes.

Edison storage-battery electric safety-lamps are in use throughout the mine; only firebosses use safety-lamps of the Wolf type for gas-testing purposes. All blasting is done with permitted explosives fired by electric battery.

The mine is ventilated by a Murphy-type exhaust-fan with a capacity of 40,000 cubic feet of air a minute, against a 1.9-inch water-gauge, driven by an Allis-Chalmers-Bullock motor.

On the last inspection of this mine it was found to be free from coal-dust; air measurements, 30,000 cubic feet of air a minute on the mine intake, divided in two splits, for the use of fifty-one men and seven mules.

No explosive gas was found. Timbering and roadways were in good condition throughout the mine.

Burrell gas-detector tests were made at regular intervals in the various airways, showing from nothing to 0.3 per cent methane.

No. 2 Mine, Extension.

James Strang, Manager; Robert L. Spruston, Overman; Robert N. Hamilton, Joseph Watson, Jno. Davidson, Edward Heyes, William Gilchrist, William Wesnedge, David Crawford, and George Carson, Firebosses.

During the year all development-work has been concentrated on the No. 4 East motor-road, which turns off at the end of the Main tunnel and continues to the No. 17 incline, a distance of 2¼ miles from the mine entrance. Three incline sections are operating off this motor-road. The East incline, driven up in close proximity to the outcrop of the seam, has Nos. 1 and 2 East levels developing on the pillar-and-stall method, the seam varying in thickness from 6 to 10 feet. Stalls are driven to the rise side of these levels, while some of the coal is recovered by dip-slants. Pillar-extraction is carried out on the west side of this incline. The No. 2 Incline section (a distance of 3,500 feet from the East incline) is operated jointly on the long-wall and pillar-and-stall methods owing to the fluctuating conditions of the seam. At the present time there are the Nos. 1 and 2 East levels and the West levels operating. The No. 17 Incline section (a distance of 3,000 feet from the No. 2 incline) is operated on the long-wall method throughout, the seam varying at this portion of the field from 2 to 4 feet thick.

Edison storage-battery electric safety-lamps are used throughout the mine; only firebosses use safety-lamps of the Wolf type for gas-testing purposes. All blasting is done with permitted explosives fired by electric battery.

The mine is ventilated by a Murphy-type exhaust-fan with a capacity of 40,000 cubic feet a minute, against a 1.9-inch water-gauge.

On the last inspection of the mine 30,000 cubic feet of air a minute was measured passing into the mine, divided into two splits.

In No. 1 split there was 15,120 cubic feet of air a minute passing for the use of forty-four men and seven mules.

In No. 2 split there was 13,545 cubic feet of air passing for the use of thirty-two men and four mules.

No explosive gas was found. Timbering and roadways were in good condition and the mine free from coal-dust.

Burrell gas-detector tests were made at regular intervals in the various airways showing from nothing to 0.2 per cent. methane.

No. 3 MINE, EXTENSION.

James Strang, Manager; Thomas Strang, Overman; Harry Mitchell, David Davidson, Daniel Campbell, James Nimmo, Patrick Malone, George Smith, and Andrew Campbell, Firebosses.

This mine is connected on to the Main tunnel at a point opposite No. 2 mine, where the motor haulage-road is continued into the slope, a distance of half a mile. Pillar-extraction is chiefly carried out in this mine; several small recovery developments are being extended with a view of recovering small areas of pillars that were abandoned in previous operations.

The haulage equipment consists of a 50-horse-power Ottumwa electric-driven hoist. The Main level haulage is operated by a Baldwin-Westinghouse 13-ton locomotive.

The mine is ventilated by a Guibal-type exhaust fan with a capacity of 50,000 cubic feet of air a minute, against a 1.5-inch water-gauge.

This mine, like the Nos. 1 and 2 mines, is equipped with the Edison storage-battery electric safety-lamp; only firebosses use safety-lamps of the Wolf type for testing purposes.

All blasting is done with permitted explosives fired by electric battery. The quantity of air measured on the last inspection registered 25,000 cubic feet of air a minute passing into the mine, divided into two splits.

In No. 1 split there was 16,000 cubic feet of air a minute passing for the use of thirty-two men and seven mules.

In No. 2 split there was 10,000 cubic feet of air a minute passing for the use of twenty-three men and four mules.

No explosive gas was found. Timbering and roadways were in good condition and the mine free from coal-dust.

Burrell gas-detector tests were made at regular intervals in the various return airways, showing nothing to 0.2 per cent. methane.

No. 6 MINE, EXTENSION.

Thomas Wilson, Overman; Walter Joyce, Shifttoss; David Coupland, Robert Houston, and Jno. McLeod, Firebosses.

This mine is opened up on the Wellington seam, about 1½ miles north-west of the Main tunnel, and is operating a small area of coal beyond the west boundary of the old workings of No. 1 mine. The Main slope, which follows the full pitch of the seam, is down a distance of 800 feet, with two pairs of levels on each side.

The method of work is pillar and stall, the seam varying in thickness from 4 to 9 feet. The method of haulage is by a 100-horse-power steam hoist situated 600 feet from the mine entrance and a main rope.

During the last inspection a record of 4,500 cubic feet of air a minute was measured passing into this mine for the use of eighteen men and one mule.

No explosive gas was found. Timbering and roadways were in good condition and the mine fairly free from coal-dust.

The Burrell gas-detector failed to show any trace of methane.

The following are the official returns from the Wellington-Extension Colliery for the year ended December 31st, 1923:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	101,119			
" export to United States	47,562			
" " other countries				
Total sales		148,681		
Lost in washing	45,919			
Used under colliery boilers, etc.	13,360			
Total for colliery use		59,279		
		207,960		
Stocks on hand first of year	2,099			
" last of year	6,426			
Difference added to stock during year		4,327		
Output of colliery for year		212,287		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	33		18		51	
Whites—Miners	302				302	
Miners' helpers	12				12	
Labourers	125		30		155	
Mechanics and skilled labour	21		49		70	
Boys			23		23	
Japanese						
Chinese	6		60		66	
Indians						
Totals	499		180		679	

Name of seams or pits—Wellington-Extension.

Description of seams, tunnels, levels, shafts, etc., and number of same—Nos. 1, 2, 3 mines connected by Main tunnel.

REPORT BY H. DEVLIN AND J. DICKSON, INSPECTORS.

No. 5 MINE, SOUTH WELLINGTON.

Thomas A. Spruston, Superintendent; William Wilson, Manager; William Brown, Overman; William McFagan, Shiftboss; Robert Ewing, Thomas Robson, Joseph Lane, Archibald Greenwell, Adam G. Watson, Neil McIntyre, James Hall, and Thomas Bullen, Firebosses.

This mine is situated at South Wellington, in the Cranberry district. It is operating in the Douglas seam, adjacent to the old Alexandria mine. The coal is shipped to Ladysmith and Mainland points over the Esquimalt & Nanaimo Railway, a small spur connecting the mine with the main line.

During the year the Main slope has been developed another 500 feet in rock-work, connecting the No. 15 South level on to the North Diagonal slope, with a view of cutting off about 3,000 feet of haulage on the North Diagonal slope.

The North Diagonal slope has been driven through a 34 feet down throw fault necessitating the development of a rock tunnel some 400 feet in extent. The South Diagonal slope has been extended about 800 feet during the year, with levels east and west of the same.

The method of mining is the pillar-and-stall system, the coal varying in thickness from 2 to 10 feet, the field throughout being very much troubled with "faults" and "barren ground."

The haulage equipment consists of a direct-driven steam hoist, 18 by 24, situated on the surface and operating the Main slope. A 100-horse-power Ottumwa electric hoist driven by a M.S.D. General Electric motor, hauls the output from the North Diagonal slope. The South Diagonal slope is operated by a 50-horse-power compressed-air-driven hoist. There are several smaller hoists situated throughout the mine to assist in local development. A 6-ton Jeffrey electric-driven locomotive handles the output from the South Diagonal and South Prospect levels to the Main slope.

The ventilation is produced in the mine by a No. 00 Keith type exhaust fan of 70,000 cubic feet-a-minute capacity, against a 1.8-inch water gauge.

Power is supplied by four Goldie & McCulloch return tubular boilers of 125 horse-power capacity each; one 250-volt d.c. Cracken Wheeler generator of 112 kw. capacity direct coupled to a 15 by 14 Ideal engine; one 250-volt d.c. Allis-Chalmers generator of 112 kw. capacity direct coupled to 16 by 16 Skinner engine; one Sullivan air compressor and supply pump.

The tipple consists of a revolving dump, chain car-haul, shaker screens, picking-table, loading-boom, and suitable arrangements for conveying the boiler fuel automatically when required.

The mine is equipped with the Edison storage-battery electric safety lamp, with the Wolf type safety-lamps used by firebosses only for gas-testing purposes. All blasting is done with permitted explosives fired by electric battery.

On the last inspection there was measured 42,750 cubic feet of air a minute passing into the mine, divided into two splits.

In the North side split there was 18,750 cubic feet of air a minute passing for the use of forty-five men and five horses.

In the South side split there was 18,000 cubic feet of air a minute passing for the use of forty-two men and three horses.

No explosive gas was found. Timbering and roadways were in good condition and the mine free from coal-dust.

The Burrell gas-detector tests have been taken at regular intervals in the various return airways, showing nothing to 0.3 per cent. methane.

The following are the official returns from the No. 5 South Wellington Colliery for the year ended December 31st, 1923:—

SALES AND OUTPUT FOR YEAR.	COAL		COKE	
(Tons of 2,240 lb.)	Tons	Tons	Tons	Tons
Sold for consumption in Canada	52,859			
" export to United States				
" " other countries				
Total sales		52,859		
Lost in washing	23,912			
Used under colliery boilers, etc.	4,662			
Total for colliery use		28,574		
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		81,433		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	10		4		14	
Whites—Miners	132				132	
Miners' helpers						
Labourers	36		8		44	
Mechanics and skilled labour	11		14		25	
Boys			8		8	
Japanese						
Chinese			21		21	
Indians						
Totals	189		55		244	

Name of seams or pits—South Wellington.
Description of seams, tunnels, levels, shafts, etc., and number of same—Slope.

REPORT BY THOS. R. JACKSON, INSPECTOR.

COMOX COLLIERIES.

CHARLES GRAHAM, DISTRICT SUPERINTENDENT.

These mines are situated in the Comox district, about 17 miles from Union Bay. A railway about 20 miles in length connects the separate mines to a shipping-point at Union Bay, over which the whole output of coal is conveyed. The mines in operation are Nos. 4, 5, and 6; the latter is a shaft acting as a means for drainage and intake air for No. 5 mine. No. 4 mine is located at the east end of Comox lake and is about 3 miles distant from the city of Cumberland. No. 5 mine is about a mile from the city. No. 6 is close to the city.

The mine ventilation of Nos. 1 and 2 slopes, of which No. 4 mine is comprised, is produced by two ventilating units. No. 1 slope fan consists of a 108-inch double-inlet reversible Sirocco fan on concrete base, with half-housing in steel, and connected to the mine by a reinforced-concrete tunnel fully equipped with explosion-doors. Fan running at 250 r.p.m. will deliver 200,000 cubic feet of air a minute, against a 6-inch water-gauge. The primary unit has a 500-horse-power synchronous motor, 2,200 volts, equipped with self-starting unit. The motor runs 500 r.p.m. and is connected to the main shaft of the fan through a jack-shaft with silent chain drive in two sections, each 15 inches wide; motor and fan-speed ratios, 2 to 1. The distance between centres of drive is 106 inches.

In addition to the primary drive there is an emergency unit, 350-horse-power induction-motor, speed 250 r.p.m., which can be connected by a coupling direct to the main shaft. This induction-motor is a duplicate of the motor now in use on the ventilating units of Nos. 4, 5, and 6 mines, and can be used on any one of the three units. The power unit is housed in a fire-proof concrete building with asbestos roofing, making one of the most complete and efficient ventilating plants in the Province.

No. 2 slope fan consists of a Sullivan reversible fan, double-inlet, having a capacity of 180,000 cubic feet of air a minute, against a 6-inch water-gauge. This fan is also electrically driven by a 350-horse-power induction-motor, 2,200 volts, speed 250 r.p.m., and is directly connected to the fan-shaft.

ELECTRIC PLANT.

The hydro-electric plant of this company has been in constant operation during the year. Sufficient electricity is generated at this plant to supply motive power to all the collieries, also the wharf at Union Bay, including the lighting of this town, Courtenay, and city of Cumberland.

DIAMOND-DRILLING.

Eleven holes were drilled, a total distance of 9,314 feet. Diamond drilling has been abandoned for the present at least.

All development-work in this mine has been abandoned and the extraction of available pillars commenced. This is now being carried out in the various sections of the mine.

NEW DEVELOPMENT AT NO. 5 MINE.

A rock slope 420 feet in length on a pitch of 17 per cent. was driven from a point 400 feet from the shaft-bottom on the Main East level to develop the No. 2 seam, which is about 115 feet below the Upper seam. After the seam was struck a return slope was driven up on the pitch of 31 per cent. and connected to old No. 1 incline, which is a direct line to the fan. From the bottom of the rock slope four slopes were turned away in the coal and are being pushed ahead as rapidly as possible. One slope is for haulage; another for power and pipe lines and to be used as a travelling-road; the other two are return airways. The haulage slope is 14 feet wide and the other slopes 12 feet wide, and all are being driven 7 feet high. The pillars left between slopes are 100 feet in width. These slopes are now down about 420 feet. They have about 2,000 feet more to go before active development of the seams will begin.

ACCIDENTS.

On February 8th an unfortunate accident occurred which resulted in the death of thirty-three workmen. About 7.15 p.m. of above date a gas explosion took place in No. 1 slope, No. 4 mine, Comox. Subsequent investigation revealed that the explosion occurred in No. 2 East level, off No. 4 slope.

Careful analysis of the lines of forces, position of bodies, timber and cars, etc., resulted in deciding that the point of origin of the explosion was somewhere near the body of Jung Tow, Chinese, found in the return side of No. 2 East level airway.

That day explosive gas was found near the face of the level on the high side of the place which formed the return airway. This was reported accordingly in the firebosses' report book above ground by Fireboss Robertson. This portion of the place was, according to him, fenced off.

It is presumed that Jung Tow went back in this airway and lighted a match for some illicit purpose, and in doing so ignited the streamer of explosive gas that no doubt nestled in the rib "roof-breaks." Being ignited at this point, it would naturally travel in the direction of the intake air-current, finally reaching the reported body of gas which worked such destruction to life and property.

(For fuller particulars *see* special report by George Wilkinson, now Chief Inspector of Mines.)

It might be appropriate to say a few words about those men who escaped with their lives though in the affected area. For instance, those who attempted to escape the danger they were in by early attempting to make their way through the impure atmosphere were overcome in the effort. Many of those who sought safety by retiring as far as possible from the deadly atmosphere and barricading themselves in were able, latterly, to pass through the affected area where those who, much earlier in the evening, had attempted escape, but met death by being overcome by the very foul atmosphere.

Some fourteen Chinese made their escape from the workings of No. 3 East level, where they remained barricaded in for three hours. Upon the foul air reaching them they decided to make their way out and managed ultimately to do so, though very much exhausted. Several white men who barricaded themselves in were finally saved, though unconscious when found by the rescue party. The mine-rescue machines were used in recovery work.

Other four fatal accidents took place in No. 1 slope, all being Chinamen. Two were killed in their working-place by fall of rock from roof, the other two met their death on the Main slope haulage-way by being struck with a passing trip.

MINE-RESCUE AND FIRST-AID WORK.

I have much pleasure in stating that the mine-rescue team representing Cumberland, also the first-aid team from that city, were both successful competitors in their respective events during the annual field meet of the V.I.M.S. Association held this year at Ladysmith. The honours won by the mine-rescue team was the shield, the first-aid team winning the Cowlam cup.

No. 4 Mine, Comox.

William Walker, Manager; John S. Williams, Overman, No. 1 Slope; Charles Parnham, Overman, No. 2 Slope; Hugh McKinnon, Shiftboss, No. 1 Slope, Charles O'Brien, Shiftboss, No. 2 Slope; Sam Horwood, John Bennie, John Marsden, Richard Hodson, W. Keenan, D. G. Marsh, Wm. Devoy, J. H. Vaughan, Wm. Beveridge, Tom Lewis, R. Walker, Jonathan Taylor, A. W. Watson, Alf Jones, John Davis, R. Reid, Fred Hutchison, Tom Shields, Wm. Herd, and Watkin Williams, Firebosses.

This mine consists of two slopes with but one main entrance. There is also a manway. No. 1 slope is 7,000 feet in length, running due north. No. 2 slope is 9,000 feet long and runs N. 45° E. These slopes diverge at a point about 75 feet from the main portal. The electric haulage-engine is so connected that trips can be run simultaneously on both slopes to a point where they converge to the main opening.

The men are conveyed from the bottom of these slopes in a man-trip at the end of each working-shift. A safety-car is connected to the rear car of the empty trip, which ensures the workmen's safety while riding up the slope. As a precaution against trips breaking away on these slopes this car is used behind all trips ascending the slopes.

The mine has been in continuous operation during the year, although not working full time.

Safety-lamps of the Wolf type are used by the firebosses; electric lamps of the Edison storage-battery type are used by all other employees. Where blasting is done only permitted explosives are used and these are fired by electric battery.

No. 1 Slope.

Electricity is used as the motive power to operate all pumps, winches, and motors. The use of mining-machines was discontinued during the first part of the year. The extraction of pillars is general throughout the mine. Seam varies from 3 to 7 feet in thickness.

No. 4 slope is practically abandoned. Cedar-wood stoppings, well placed in ribs and roof and faced with cement, have been placed near the top of No. 4 slope to shut off the abandoned workings and prevent gas from leaking into the present workings.

The presence of gas gave considerable trouble as the pillars were extracted towards the top of this slope, due to the nature of the overlying strata in close proximity to the seam itself.

During my last visit of inspection in December I measured 32,000 cubic feet of air a minute passing through the tunnel at the bottom of the Main slope, divided into two splits.

No. 1 Split Section.—There was 8,280 cubic feet of air a minute passing for the use of twenty-four men and a mule. I found explosive gas in No. 1 left and bottom right places (both in gob). Sections practically free from coal-dust. General conditions good. This return air is tested on No. 17 West level, No. 2 slope.

No. 2 Split Section.—There was 17,280 cubic feet of air a minute passing for the use of twenty men and two horses. I found explosive gas at face of two stoppings off No. 1 West level, No. 4 slope; also a ¼-inch gas-cap in No. 1 West level pillars. Sections practically free from coal-dust. General conditions fairly good. Burrell gas-detector test taken at last working-face of this section showed 1.6 per cent. methane in 12,500 cubic feet of air a minute passing. At No. 15 West level overcast Burrell gas-detector test was 1.3 per cent. methane in 25,540 cubic feet of air a minute passing. (Notice.—*Re* gas at stoppings: Arrangements made to have same removed immediately.)

No. 11 West Level Section.—This section is being reopened and is well ventilated. Found no explosive gas. Practically free from coal-dust and general conditions good.

I examined all report-books as required under section 91, subsections (4) and (36), of the "Coal-mines Regulation Act" and found them being complied with.

Measured 65,000 cubic feet of air a minute passing into No. 1 fan. The Burrell gas-detector showed 0.6 per cent. methane in this air. Measured 78,000 cubic feet of air a minute passing into No. 2 fan. The Burrell gas-detector showed 0.4 per cent. methane in this air.

No. 2 Slope.

Mining-machines have been discontinued in this slope. Extraction of pillars is general throughout the mine. No. 6 East and No. 7 West levels are being reopened for the extraction of pillars these areas contain.

The haulage system is similar to that which obtains in No. 1 slope. The 5½ ton motor employed on No. 15 West level, No. 1 slope, may shortly be removed to No. 15 East level No. 2 slope, as a substitute for mules.

As was to be expected, the ventilation of both slopes has been much improved owing to the shortening-up of the roadways, etc., due to the retreating system employed.

During my visit of inspection in December I measured 140,000 cubic feet of air a minute passing into this mine. I measured 47,700 cubic feet of air a minute passing at a point in the Main slope immediately above No. 15 East level, which divided into three splits.

No. 1 Split Section.—There was 16,000 cubic feet of air a minute passing for the use of thirty men and five mules. Found no gas. Section free from coal-dust owing to water and mud. General conditions good. Burrell gas-detector test in this return showed 0.1 per cent. methane.

No. 2 Split Section.—There was 10,700 cubic feet of air a minute passing for the use of thirty men and four mules. Found no explosive gas, but got a ¾ inch gas-cap at face of No. 17 West level places. Sections practically free from coal-dust, mostly owing to dampness and water covering this area. General conditions good. Burrell gas-detector test in this return showed 1 per cent. methane. (NOTICE.—*Re* ¾ inch gas-cap: More air required where this gas-cap prevails in order to reduce methane content of ventilation.)

No. 3 Split Section.—There was 13,000 cubic feet of air a minute passing for the use of forty men and three mules. Found no explosive gas, but got a ½-inch gas-cap at face of No. 30 East level. General conditions fairly good. Sections practically free from coal-dust owing to dampness and water. Burrell gas-detector test made at No. 15 East overcast covering all return air from East side slope workings showed 0.6 per cent. methane in 35,700 cubic feet of air a minute passing.

No. 5 MINE, COMOX.

John G. Quinn, Manager; Robert Brown, Overman; Duncan Thomson, Thomas Eccleston, John E. Spilcer, Jas. Brown, Jas. Monks, Tom Wilson, Sam Jones, and Frank Crawford, Firebosses.

The workings of this mine are reached by a shaft 280 feet deep; it is now called No. 1 seam. A slope has been driven off No. 1 seam (not far from the shaft bottom), tapping another seam of coal which at the present time is 27 inches in thickness. This seam is 115 feet below No. 1 seam and is called No. 2 seam.

The workings of No. 1 seam have been abandoned except the area around the West side, comprising East and West levels down to No. 4, below which it is being allowed to fill with water.

In the West side district of the slope a Sullivan coal-cutting machine undermines a strip of coal about 200 feet wide and 3½ feet in thickness. The balance of coal obtained is by extraction of pillars.

In No. 2 seam the workings are being opened out by means of coal-cutting machines of the Sullivan approved type. Depth of cut, 6 feet. A new feature to these machines has been applied. They have been fixed in conformity with British electrical mining laws, which sets a high standard of safety for such power-driven machines.

The Edison electric safety-lamp is used for lighting. Firebosses use safety-lamps of the Wolf type for testing for gas. Only permitted explosives are allowed. No blasting is done without the use of cable and battery.

Coal production in this mine ceased on April 25th and no coal was mined until December 10th, when it was reopened for the extraction of pillars on the West side slope.

During my last visit of inspection in December I obtained the following air measurements: Quantity entering No. 1 seam was 42,000 cubic feet of air a minute. Quantity entering No. 2 seam was 60,000 cubic feet of air a minute. Found no explosive gas. Sections practically free from coal-dust and general conditions good.

No. 1 Seam.—West side split section: There was 15,000 cubic feet of air a minute passing for the use of ten men. East side split section: There was 25,000 cubic feet of air a minute passing for the use of thirty men and five mules.

No. 2 Seam.—No. 1 split section: There was 20,000 cubic feet of air a minute passing for the use of twenty men and a mule.

Burrell gas-detector test in return airway of No. 1 seam was 0.3 per cent. methane. In No. 2 seam return it was less than 0.1 per cent. methane.

I examined all report-books as required under section 91, subsections (4) and (36), of the "Coal-mines Regulation Act" and found them correct.

No. 6 Mine, Comox.

John G. Quinn, Manager; Thomas Mordy, Overman.

There has been no coal hoisted from this shaft during the year. Practically all the water made in both Nos. 5 and 6 mines is hoisted from No. 6 shaft by specially constructed tanks capable of delivering 1,200 gallons a minute.

During my last inspection I measured 24,000 cubic feet of air a minute passing into this mine. Found a little explosive gas in No. 2 stall at face off No. 7 East level. Other conditions of the mine were fairly good.

No fatal accident occurred during the year in either No. 5 or No. 6 mine.

The following are the official returns for the year ended December 31st, 1923, of the aggregate output of all the Comox Collieries:—

Sales and Output for Year.	Coal.		Coke.	
(Tons 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	224,403			
" export to United States	2,225			
" " other countries				
Total sales		226,628		
Lost in washing	46,325			
Used under colliery boilers, etc	4,914			
Total for colliery use		51,239		
		277,867		
Stocks on hand first of year	7,283			
" last of year	5,634			
Difference taken from stock during year		1,649		
Output of colliery for year		276,218		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	45		22		67	
Whites—Miners	91				91	
Miners' helpers	2				2	
Labourers	78		42		120	
Mechanics and skilled labour	99		81		180	
Boys			7		7	
Japanese—Miners	39				39	
Miners' helpers	39				39	
Labourers	13				13	
Chinese—Miners	80				80	
Miners' helpers	60				60	
Labourers	47		39		86	
Totals	593		191		784	

Name of seams or pits—Comox.

Description of seams, tunnels, levels, shafts, etc., and number of same—Nos. 4, 5, and 6 shafts and Nos. 4 and 7 slopes. Nos. 4 and 6 shafts and No. 7 slope not operating at present.

NORTHERN INSPECTION DISTRICT

FROM REPORT BY T. J. SHENTON, INSPECTOR

TELKWA COLLIERY, TELKWA DISTRICT

Broughton & McNeil, Telkwa, Agents; J. Gillespie, Mine Foreman

This operation began on May 1st of current year, and the average number of men employed for the period from that date to the end of November was two, and for the balance of the year or December month, was eight.

All operations are governed by the "Coal mines Regulation Act."

The following are the official returns from the Telkwa Colliery for the year ended December 31st, 1923:—

SALES AND OUTPUT FOR YEAR.	COAL		COKE	
(Tons of 2,240 lb.)	Tons	Tons	Tons	Tons
Sold for consumption in Canada	335			
" export to United States				
" " other countries				
Total sales		335		
Used in making coke				
Used under colliery boilers, etc.				
Total for colliery use				
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		335		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND		ABOVE GROUND		TOTALS	
	No. employed	Average Daily Wage	No. employed	Average Daily Wage	No. employed	Average Daily Wage
		$		$		
Supervision and clerical assistance	5	6 (0)	1	5 (0)	6	
Whites—Miners						
Miners' helpers	3	6 (0)				
Labourers	3	6 (0)				
Mechanics and skilled labour						
Boys						
Japanese						
Chinese						
Indians						
Totals						

Name of seams or pits—Goat Creek seam, located on Goat creek 3½ miles from Telkwa.

Description of seams, tunnels, levels, shafts, etc., and number of same—One tunnel 150 feet in hill; three rooms off said tunnel.

Description and length of tramway, plant, etc.—The plant consists of one mule and four mining cars, bunkers, scales, rails, etc.; buildings, bunk house, cook house, and office.

AVELING COLLIERY, TELKWA DISTRICT.

BETTY MINE.

J. Gillespie and J. Wilson, Operators.

The operation of the Betty coal-mine ceased during the month of April of this year. Number of men employed for the period from January to April was five.

All operation was carried on under the direction of the "Coal-mines Regulation Act."

PEACE RIVER DISTRICT.

NOTES FROM THE RESIDENT MINING ENGINEER.

A new coalfield is being developed at the Peace River canyon, which has made small experimental shipments of coal.

The following are the official returns from the Peace Canyon Colliery for the year ended December 31st, 1923:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL. Tons.	COAL. Tons.	COKE. Tons.	COKE. Tons.
Sold for consumption in Canada	*65			
" export to United States				
" " other countries				
Total sales		65		
Used in making coke				
Used under colliery boilers, etc.				
Total for colliery use				
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		65		

* By barge to railway at Peace River Crossing, 40 tons; to Hudson Hope, 15 tons; by Hudson's Bay Company's boat, 10 tons blacksmith-coal.

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND. No. employed.	UNDERGROUND. Average Daily Wage.	ABOVE GROUND. No. employed.	ABOVE GROUND. Average Daily Wage.	TOTALS. No. employed.	TOTALS. Average Daily Wage.
Supervision and clerical assistance			2			
Whites—Miners	2					
Miners' helpers						
Labourers						
Mechanics and skilled labour						
Boys						
Japanese						
Chinese						
Indians						
Totals	2		2		4	

NICOLA-PRINCETON INSPECTION DISTRICT

REPORT BY JOHN G. BIGGS, INSPECTOR

I have the honour to herewith submit my annual report as District Inspector of Mines for the Nicola-Princeton District during the year 1923.

The coal-mining companies operating in this district during the present year were as follows: The Middlesboro Collieries, Limited; Coalmont Collieries Limited; Princeton Coal and Land Company, Limited; Fleming Coal Company, Limited; and Chu Chua Coal Company, Limited. The Middlesboro, Coalmont, and the Princeton Collieries were operated during the whole of the year, while the Fleming Colliery ceased operations during the month of March and again commenced operating at a new prospect during the month of November. The Chu Chua Coal Company ceased operations during the month of January and has not done anything further during the present year.

It is gratifying to report that we have not had any fatal accident at any of the operating mines in this district during the year, which can only be attributed to the care of the various officials and workmen co-operating to promote a common object, with an earnest endeavour to make conditions better and safer in the mines.

Seven minor accidents have been reported to this office during the year, six of which occurred at the Coalmont Colliery and one at the Middlesboro Colliery, which may be summarized as follows: Three accidents while the miners were engaged in timbering their working faces, two owing to being caught by mine-cars; one had index finger taken off by a mule-chain, and one owing to a rock sliding from the gob side of working place.

The general conditions of the mines have been fairly good during the year and it was only on very rare occasions that I have been able to find any trace of methane at the working faces. A general use of the Burrell gas-detector is at present being made by the firebosses for testing the return mine-air current in the various splits of the mines, and the percentage of methane given off is found to be low. Samples of mine air have been regularly taken at the various splits and forwarded to the Department of Mines, Ottawa, for analysis, when the percentages of methane present in the mine atmosphere was found to range from nothing to 0.13 of 1 per cent. Details of this is contained in report of Chief Inspector.

Inspection of mines on behalf of workmen as provided by section 91, Rule 37, of the Act has been fairly well adhered to at the mines and conditions reported have been favourable, and in no case have reports been made as to the existence or apprehended existence of any danger.

MINE FIRES.

Mine fires, which may be attributed to spontaneous action in the gobs and disused roads of the mines, have been too evident at the various mines operating in this district during the past year, and are undoubtedly caused by the unusual thickness of the coal seam, the character of the coal, the presence of faulting, and other geological conditions which contribute to this spontaneous heating. In the Princeton District we have a seam of high grade bituminous coal with an average thickness of about 25 feet, high in moisture, which has a great affinity for oxygen and absorbs it very readily, requiring the greatest attention to guard against this spontaneous action. During the present year spontaneous heating of the gobs of the No. 2 and 3 mines of the Coalmont Colliery has been a great source of trouble and expense, and from past experience it is hard to see how it may be avoided, as we find most unusual conditions to prevail. Presence of faulting in these measures is found to be very pronounced and they have a pitch ranging from 30° near the croppings of the No. 2 mine to 6° at the face of the slope in No. 3 mine, comprising about 180 feet of bituminous coal of varying quality, intersected by thin bands of shales. The coal is high in volatiles and of an open structure, subject to crush. The fourth seam of this series which is now under operation has an average thickness of 14 feet and is overlaid by approximately 25 feet of inferior coal, causing the gobs in the pillar area to be loaded with timber and carbonaceous material. This is at all times ready to stimulate heating, and experience goes to show that this is one of the greatest sources of trouble encountered at these mines. As a result the method of work adopted was of vital importance, so as to be in a position to deal with such conditions should they arise. As a result I may state we have been fairly successful in dealing with this source of trouble during the year at these mines.

The Nicola field is no exception to the rule, where we have highly inclined seams of coal, with an open structure, subject to crushing, high in volatiles, and subject to pronounced faulting. The thicker portions of the seams are subject to self-heating.

Gob-fires have been one of the greatest sources of trouble in operating coal-mines in this district, and while we may not at present know of any way to prevent this self-heating, a method of work may yet be adopted which is best calculated to produce coal with the least possible danger from fire, and at the same time affording the greatest facilities for dealing with the latter should it arise. While it may be impossible to lay down any hard-and-fast rules for regular application as to the method of work, so these in all cases must be conditional to circumstances, but the general conditions appear to lend themselves to dividing the mines into separate and distinct splits, provided with roads and airways of liberal sectional area and the use of a low ventilation pressure.

Middlesboro Collieries, Ltd.

Head Office—Vancouver, B.C.

Capital, $1,107,700.

Officers.	*Address.*
E. W. Hamber, President,	P.O. Box 500, Vancouver, B.C.
G. S. Raphael, Vice-President,	P.O. Box 500, Vancouver, B.C.
Thos. Sanderson, Managing Director and Sec.,	P.O. Box 500, Vancouver, B.C.
C. M. O'Brian, Treasurer,	P.O. Box 500, Vancouver, B.C.
Robert Fairfoull, Mine Manager,	Middlesboro, B.C.

Value of plant, $250,000.

MIDDLESBORO COLLIERY.

Robert Fairfoull, Manager.

This colliery is operating in the north-west portion of the Nicola basin and is situated about a mile west of the city of Merritt; it is connected by a branch line off the Kettle Valley Railway, which serves both the Middlesboro and the Fleming Collieries.

During the present year there has been little change required at this plant, the working area of the several mines being somewhat extensive for the output required, while the mines are not worked to their capacity and operated very intermittently during the present year owing to market conditions.

No. 4 MINE.

James Fairfoull, Overman; William Hallinan, Robert Dey'rough, Thomas Smith, and Thomas Rowbottom, Firebossers.

This mine is the largest and most extensive of the mines operated by the Middlesbury Company and is developed by a large and well-maintained level entering the foot of the hill on the same elevation as the mine tipple, and is generally driven in the rock adjacent to and running parallel with the measures, and developing the Nos. 4, 5, 6, 8, and 9 seams by means of branch drifts driven from the Main level and cutting across the measures. It is at present operating in the Nos. 6, 8, and 9 seams of this property, which have an average thickness of 5 feet of fairly good bituminous coal and generally overlaid with a shale roof.

The method of work adopted is the pillar-and-stall system, the headings are driven from the No. 4 Main level, following the full pitch of the seam, which is about 20° to the surface croppings at the apex of the hill and are approximately 1,000 feet in length and an opening made to the surface for facilitating the handling of timber for the workings and the ventilation. From these Main headings levels or dump-car roads are driven, following the strike of the seams, with the necessary crosscuts for ventilation to the various boundaries or fault lines. Upon being reached, the coal in the pillars is drawn back to close proximity to the headings.

The coal is loaded at the various faces into small dump-cars, trammed by hand to the headings, and dumped into chutes, where it is conveyed to the No. 4 level, loaded into the mine-cars, drawn to the landings by mules, and hauled to the surface by main and tail rope haulage.

During the present year the rock tunnel which is adjacent to the No. 6 seam has been extended a further distance of about 300 feet and an opening made into the No. 6 seam, where at present a new section of the mine is being developed; also the rock tunnel adjacent to the No. 8 seam has been extended a distance of about 150 feet. The system of driving the No. 4 Main level in the rock near the coal-seams is favoured at this mine, as it prevents any heavy timbering that would be necessary if the levels were driven in the coal-seams and assures the level being in good condition and prevents any "squeezing" taking place when the pillars are being drawn above.

The coal is of a friable nature and is mined by hand; it is blasted when required by permitted explosives, all shots being fired by electric detonators under the supervision of certified shotfirers.

Ventilation is produced by a 8.5 double-inlet fan, belt-driven by a 14 by 18 Ideal steam-engine situated near the entrance to the No. 4 level, and so constructed as to be reversible when required, and owing to there being a difference of about 500 feet in elevation between the No. 4 level and the outlets it is greatly assisted by the natural ventilation of the mine.

During my last visit to this mine ventilation measured showed 35,000 cubic feet of air a minute passing into this mine for the use of seventy-three men, divided into three splits. The No. 6 split passing 14,000 cubic feet a minute for the use of forty-six men; the No. 8 split passing 10,800 cubic feet a minute for the use of twenty-one men, and the No. 9 split passing 5,000 cubic feet a minute for the use of six men. Speed of fan, 120 r.p.m., water-gauge 0.7 inch. The doors and stoppings were in good condition and the air well conducted around the working faces and were free from any trace of explosive gas.

Burrell gas-detector tests were as follows: No. 6 split, *nil*; No. 8 split, 0.1 per cent.; No. 9 split, *nil*.

The workings I found to be well timbered and a sufficient supply of suitable timber provided for the use of the workmen. The headings and haulage roads were in fair condition, while the No. 4 level was in good condition and, being naturally damp, was free from dangerous coal-dust.

PROSPECT MINE.

This mine is operating in a small area of coal situated above the No. 1 level of the No. 4 East mine and the surface croppings, and not being accessible from the No. 4 East mine, and is in the No. 4 seam, is entered by a slope driven from the surface, and has been extended a distance of about 300 feet, all operations being to the west of this slope.

Mining is very restricted owing to the limited area of the ground, and may be considered as a "pocket" of friable coal of unusual thickness, very irregular and subject to minor faulting. It is overlain with a soft shale roof and is subject to "squeeze," making it hard to maintain roads, and as a result all the working faces and roads are timbered with heavy framed sets.

During my last visit of inspection I found the working-faces to be well timbered and a sufficient supply of suitable timber provided for the use of the workmen. The roads were well timbered and in fair condition and, being naturally damp, were free from dangerous coal-dust.

Ventilation was fairly good (produced naturally) for the use of nine men and was well conducted around the working-faces, which were free from any trace of explosive gas.

This mine is supervised by the No. 4 East officials, being in close proximity to the same.

No. 4 East Mine.

A. D. Allen, Overman; Louis Clark, Fireboss.

This mine is situated 1,500 feet east of the entrance to the No. 4 mine and has been developed by a pair of 15-per-cent. slopes driven from the surface croppings, and is operating in the No. 4 seam of this property.

The measures in the lower section of this mine are found to be very irregular, friable, and the coal-seam "pockety," very subject to spontaneous action, and as a result necessitated the sealing-off of the lower section of this mine during the month of August. Operations are at present being conducted from the No. 5 West level, which is situated above this sealed-off area, and is operating in the lower portion of the seam; work at present being more or less of an exploratory nature and consists of a pair of levels and the necessary crosscuts for ventilation.

Ventilation is produced by a small double-inlet Sheldon belt-driven fan situated near the entrance to the counter-slope, and during my last inspection was producing 9,828 cubic feet of air a minute for the use of nine men; water-gauge, 0.3 inch. I found the air well conducted around the working-faces, while the brattice, doors, and stoppings were in good order.

The working-faces were well timbered and a sufficient supply of suitable timber was provided for the use of the workmen; the roads were in good condition and, being naturally damp, were free from dangerous coal-dust. Burrell gas-detector test showed the return air to contain 0.1 per cent. methane.

No. 5 West Mine.

Andrew McKendrick, Overman; Matthew McKibben, Fireboss.

This mine is situated on the west side of Coal gully, 800 feet north of the entrance to the No. 7 mine, and is operating in the No. 1 seam of this property, which is a thick, friable, and irregular seam overlaid with a soft shale roof, and on the west side of the slopes has been subject to a great deal of faulting, with practically all the operations at present being conducted on the east side of the slope in close proximity to the workings of the old No. 1 mine.

This mine has been developed by a well-timbered 9 by 7 level from the surface croppings on the side of the gully, which was extended a distance of 350 feet, with raises driven to the surface croppings for ventilation purposes. At the face of the Main level 30-per-cent. slopes were driven to the full dip of the seam, a distance of 600 feet, when it was found hard and costly to maintain roads, and as a result work has been commenced upon drawing back the pillars. Both the roads and the working-faces of this mine are timbered with heavy framed sets which require to be well lagged both on the roof and sides, while the floor is subject to "heaving," and owing to the pitch of the seam the coal from the various faces is conveyed to the mine-cars on the levels by chutes.

During the present year a 4-foot belt-driven Sheldon fan has been installed near the entrance to the counter-level of this mine, running at a speed of 250 r.p.m., and is driven by a 25-horse-power constant-speed motor, A.C. induction type, 200 volts, 70 amperes, 3-phase, 60 cycles; speed of motor 860 r.p.m.; during my last inspection it was producing 20,000 cubic feet of air a minute for the use of twenty-six men; water-gauge, 0.5 inch.

I found the working-places to be well timbered and a sufficient supply of suitable timber provided for the use of the workmen. The roads were well timbered and in fair condition.

Burrell gas-detector test showed the return air to contain 0.2 per cent. methane.

No. 5 East Mine.

This is a small mine situated 300 feet north of the entrance of the No. 7 mine and is operating in a section of the No. 5 seam between the old workings of the No. 5 mine and the surface croppings, which is about 5 feet in thickness, overlaid with a firm shale roof and a very irregular and rolling floor, causing this seam to vary in thickness and pinch out frequently.

This mine has been developed from the surface by a 10 per cent slope 450 feet in length, with levels driven off at varying intervals, following the contour of the seam to the surface croppings, the present workings being very limited.

Ventilation measured showed 4,000 cubic feet of air a minute passing at this mine (produced naturally) for the use of ten men; the air was well conducted around the working faces, while the stoppings were in good order. The working places were well timbered and a sufficient supply of suitable timber was provided for the use of the workmen. The roads were in good condition and well timbered and free from dangerous coal-dust, while Burrell gas-detector test failed to show any trace of methane in the return air of this mine.

Main-rope haulage is used at the slopes of the Nos. 5 East, 5 West, and the No. 7 mine, where the mine-cars are drawn and collected at one common siding again to be hauled by main rope haulage to the top of the surface incline, where they are lowered by gravity in two car trips to the mine-tipple.

This mine, being in close proximity to the entrance to No. 7 mine, is supervised by the No. 7 mine officials.

No. 7 Mine.

Andrew McKendrick, Overman; William Adamson and George Walker, Firebosses.

The entrance to this mine is situated in Coal gully at an elevation of 400 feet above the mine-tipple. The mine has been developed from the surface croppings by slopes following the full pitch of the seam and operating in the No. 4 seam of this property, which has an average thickness of from 15 to 20 feet, with the workings generally conducted in the upper portion of the seam.

Operations during the present year have been confined to the extraction of pillars in close proximity to the slopes, and as a result of the limited area has retreated rather quickly and is at present operating in pillars near the surface croppings, making the life of this mine very short and limited to a very few months.

Owing to the limited area of this mine ventilation is at present produced naturally, which I found to be fairly good for the use of ten men. The working places are from 10 to 12 feet in height, with the pillars subject to "crush" and as a result the coal is friable, very little blasting being required.

The working-places are well timbered and a sufficient supply of suitable timber provided for the use of the miners. The roads were in fair condition and, being naturally damp, were free from dangerous coal-dust. A Burrell gas-detector test failed to show any trace of methane in the return air of this mine.

The coal at these mines is mined by hand and blasted when required by explosives of the permitted class, all shots being fired by electric detonators under the supervision of competent persons appointed for the purpose. Edison electric safety-lamps are used by all the workmen and safety-lamps of the Wolf pattern by the officials for inspection purposes.

The coal from the various mines is brought to a common tipple in cars having a capacity of 1.5 tons, where they are dumped by a Phillips crossover dump, a switchback and car haul bringing the empties back, and are arranged into trips for whatever place required. The coal passes to a shaking screen which allows the slack to pass into a hopper, the larger coal passes over a picking-table 42 feet in length, where the rock and waste is picked out before being loaded into the railway-cars.

To facilitate the loading of box cars a Christy box-car loader is used. The main power plant is situated near the tipple and consists of four return tubular boilers with an aggregate of 600 horse-power. A Canadian Rand cross-compound air-compressor with a capacity of 2,000 cubic feet of air a minute is used for driving mine-hoists, fans, etc., while a 2 [illegible] volt alternating generator is used for pumping and lighting purposes.

Copies of the "Coal-mines Regulation Act," special rules, and plans of the mines are well posted near the entrance to the several mines.

The following are the official returns from the Middlesboro Colliery for the year ended December 31st, 1923:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lbs.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	70,139			
" export to United States				
" " other countries				
Total sales		70,139		
Used in making coke				
Used under colliery boilers, etc	5,811			
Total for colliery use		5,811		
		75,950		
Stocks on hand first of year	536			
" last of year	448			
Difference taken from stock during year		88		
Output of colliery for year		75,862		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	12		5		17	
Whites—Miners	66	5.00-10.00			66	
Miners' helpers	19	4.20			19	
Labourers	54	4.00 - 5.00	19	4.30 - 4.70	73	
Mechanics and skilled labour			14	4.25 - 5.80	14	
Boys			8	2.00 - 2.75	8	
Japanese						
Chinese						
Indians						
Totals	151		46		197	

Name of seams or pits—No. 4, No. 4 East, No. 5 East, No. 5 West, and No. 7 mines.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 4 mine, in which is mined the coal from Nos. 6 and 8 seams. Access to these workings is by an entrance situated near the tipple; thence by a horizontal tunnel driven in the No. 5 seam; thence by crosscut tunnel to Nos. 4, 8, and 6 seams. The seams in this mine vary from 5 to 8 feet in thickness, pitching south, the angle of inclination being about 30°. The coal is conveyed from the face to the car by chutes and then hauled in the mine-cars by compressed-air hoists to the tipple. Ventilation is produced by Sheldon fan driven by Ideal steam-engine, 14 by 18 inches, and is also arranged that the direction of air-current can be changed. No. 4 East, from which is mined coal from the No. 4 seam, about 18 feet in thickness, pitches south-east; angle of inclination, 15°. Access is gained to the workings by a slope driven east; haulage is by rope connected to steam-hoist on the surface. No. 5 East: Development-work on a small scale has been continued in this mine during the past year, the slope and levels being extended. No. 5 West: The slope and levels in this mine were extended until they connected with the abandoned No. 1 mine, this being the ultimate point to which it had been deemed advisable to advance. Pillar-drawing has now commenced in this section, development-work

being continued by driving a tunnel through rock to the coal beyond a fault. No. 7 mine. Operations in this mine are confined to pillar drawing.

Description and length of tramway, plant, etc.—The power plant consists of four return tubular boilers, 150 horse-power, fitted with Goldie-McCulloch feed-water heater, Canadian Rand cross-compound compressor, capacity 2,000 cubic feet of free air a minute, 75 kw. 230-volt General Electric generator, direct-connected to Ideal compound engine from which is driven the pump supplying water to the camp and works and the fan ventilating No. 5 West mine. A tipple built by the Roberts-Schaeffer Company handles all the coal, situated near which are the machine and carpenter shops. Access to the main line, Kettle Valley Railway, is gained by a spur about a mile long, the connecting point being near the railway village at Merritt.

The Fleming Coal Company, Ltd.

(FORMERLY THE INLAND COAL AND COKE COMPANY, LTD.)

Head Office—Vancouver, B.C.

(IN LIQUIDATION.)

W. E. Hodges, Liquidator, Bank of Nova Scotia Building, Vancouver.

COAL HILL COLLIERY.

A. E. Smith, Manager; John T. Brown, Overman; George Maxwell and J. W. Smith, Firebosses.

This property is situated near the apex of the foot-hills, 2 miles south-west of the city of Merritt, and operating in the north-west portion of the Nicola basin; it is bounded on the east by the holdings of the Middlesboro Collieries and on the west by tap-rocks, with the croppings of the various seams approaching the surface. Three workable seams of coal have been operated on this property—namely, the Nos. 2, 3, and 5.

During the year 1920 the entrance to the Nos. 3 and 5 seams was sealed off owing to gob-fires, when the No. 2 or the top seam was opened from the surface croppings and was operated until February of the present year, when work in this seam ceased owing to being exhausted. As a result rather an aggressive prospecting policy was followed during the year 1922, with a staff of employees engaged in sapping, ditching, and excavating in the western portion of the field beyond the surface croppings of the No. 3 seam, which is the lowest operated upon this property, when a seam of coal was exposed and correlated as the No. 1 or lower seam. However the location of this showing was not considered favourable to commence any operations when it was decided to operate this seam by driving a rock tunnel driven into the side hill at a lower elevation near the top terminal of the surface incline, which would facilitate the haulage, etc.

This rock tunnel was driven a distance of 500 feet, when it encountered a 5-foot seam of coal which was intersected with two bands of rock 40 feet below the No. 3 seam and above the No. 1 seam, and after being operated for a short time was found to be of an unsatisfactory character. As a result work was suspended at this colliery during the month of March, the company going into voluntary liquidation, but was reorganized as the Keystone Coal Company and again resumed operations with a small staff of employees during the month of November in the south-east portion of the property, by driving a slope from the surface croppings of what is expected to be the No. 1 or lowest seam, the present work being only of a prospective nature to prove this seam of coal.

The following are the official returns from the Fleming Colliery for the year ended December 31st, 1923:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	3,598			
" export to United States				
" " other countries				
Total sales		3,598		
Used in making coke				
" under colliery boilers, etc	436			
Total for colliery use		436		
		4,034		
Stocks on hand first of year	80			
" last of year				
Difference taken from stock during year		80		
Output of colliery for year		3,954		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	2	6.00	1	6.00	3	
Whites—Miners	16	7.00			16	
Miners' helpers	4	4.50			4	
Labourers	3	4.50	3	4.00	6	
Mechanics and skilled labour			2	5.50	2	
Boys						
Japanese						
Chinese						
Indians						
Totals	25		6		31	

The above return was for four months only.

Name of seams or pits—Nos. 2 and 6 mines.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 2 mine after operating for several years became exhausted early in the year. No. 6 was opened by a rock tunnel 425 feet long early in the year and proved to be 6 feet thick, but after considerable development two bands of rock—one 8 inches thick a foot from the roof, and the other 6 inches thick of very friable white shale in the middle of the seam—rendered the product of the seam unsaleable unless an expensive cleaning plant was installed. The Keystone Coal Company, Limited, has taken a bond on the property and intends to open up a lower seam by driving a slope. The property has plant, equipment, and facilities to handle 500 tons a day.

Chu Chua Coal Co., Ltd

Officers.	*Address*
A. H. B. Jordan, President,	Everett, Wash.
W. H. Glass, Vice-President,	Seattle, Wash.
O. A. Thomas, General Manager,	Seattle, Wash.
Major H. S. Hodgson, Secretary-Treasurer,	616 Alaska Bldg., Seattle, Wash.
David Brown, Manager,	Chu Chua, B.C.

CHU CHUA COLLIERY.

David Brown, Manager; John Sullivan, Fireboss.

This property is situated 55 miles north of the city of Kamloops, on the north side of the Thompson river, and comprises part of the foot-hills and flats of the Indian reservation, with a road running down the valley a distance of about 3,000 feet to a siding on the Canadian National Railway, which makes this property very accessible to transportation.

There are several small coal-exposures found cropping at the side of Newbykulst'n creek, the largest of which are known as the Gray and Thomas seams, and as a result work has been generally confined to these two seams of coal.

This property has been operated very intermittently since the year 1920. The Gray seam, which is the lowest exposure in this series and has a thickness of about 5 feet, was uncovered in the creek-bed during the year 1921 and was developed from the surface by slopes. However, it had a tendency to change at short distances, possessed a laminated structure, was high in ash, and as a result operations in this seam of coal ceased during February, 1922.

The chief development on this property has been on the Thomas or Upper seam, where mining conditions are found to be very favourable. The measures are of a firm nature, the coal hard and of a satisfactory character, and was able to command a market. However, it was found to be very small and intersected by bands of rock, was not operated with any commercial success, and as a result operations ceased at this property during the month of January of the present year.

The lower portion of these measures are covered with glacial drift and mud flats, making it hard to prospect, and it would appear to me rather unfortunate that this property has not been drilled to prove the measures below the Gray seam, which is the lowest exposure found in the creek-bed.

Coalmont Collieries, Ltd

Head Office—Coalmont, B.C.

Capital, $3,000,000.

Officers.	*Address*
W. J. Blake-Wilson, President,	Vancouver, B.C.
Gen. J. W. Stewart, Vice-President,	Winnipeg, Man.
A. H. Douglas, Secretary,	Vancouver, B.C.
D. J. McLeod, Treasurer,	Vancouver, B.C.
Donald McLean, Manager,	Coalmont, B.C.

COALMONT COLLIERY.

George Murray, Overman; John Gillham, Shiftboss; John McMurtrie, Thomas Bosworth, Thomas Leaman, Robert Gourley, James Webster, Jim Simm, and T. C. Vincent, Firebosses.

This colliery is situated in the Similkameen Mining Division, between the fork of the Tulameen river and Granite creek, 170 miles east of the city of Vancouver and 12 miles west of the town of Princeton, and is connected by a spur off the Kettle Valley Railway at the town of Coalmont, where the mine-tipple is situated. Mining operations are being conducted on the south-west side of the North fork of Granite creek from the surface croppings, which are situated

at an elevation of 1,600 feet above and 4 miles from the mine-tipple, which is connected by an overhead tramway.

These measures may be described as a conformable basin of coal having an aggregate thickness of about 160 feet intersected by small bands of rock, bone, and shale, having the greatest inclination near the croppings and flattening off considerably at the face of the slopes of the No. 3 mine, and is at present operating in the fouth seam of the series, where from 12 to 14 feet of good bituminous coal is at present being extracted.

No. 2 MINE.

The entrance to this mine is situated at an elevation of 3,764 feet and has been developed by a well-maintained 7 by 9 level known as the No. 2 level, and follows the strike of the seam a distance of 3,250 feet, when a large intrusive dyke was encountered at the face of the level, and after a little prospect-work had been done at the face it was decided to withdraw and cut this fault from the No. 3 mine main level.

All the work done in this mine has been to the raise of the Main level and the surface croppings, which are generally reached at a distance of 700 feet, with a solid pillar of coal having an aggregate thickness of 125 feet left intact between the No. 2 and the No. 3 mine main levels, chiefly to protect the No. 3 mine against any spontaneous action that should take place in the No. 2 mine, as all indications went to show that there would, and it was the intention of the management to develop this property by the No. 3 or the Wilson tunnel.

The coal to the raise of the No. 2 mine main level was exploited by five main headings following the full pitch of the seam, and were provided with chutes into which the coal from the various faces was dumped by small dump-cars and carried to the Main level, where it was loaded into the regular mine-cars and hauled to the surface in trips by horse-teams.

During the present year all the coal produced from this mine was extracted from the pillars, when considerable trouble was experienced by spontaneous heating of the gobs, which are found to be very susceptible to heating; fortunately this trouble was kept under control, and as a result practically all the available coal in this seam was drawn back and sealed off by permanent stoppings during the month of September of the present year.

No. 3 MINE.

This mine is situated 400 feet east of and at an elevation of 39 feet below the No. 2 mine main level, and is situated on the same elevation as the top terminal of the overhead tramway. The intention was to use No. 3 mine as the main level for developing this property; it was therefore developed by a well-maintained 8 by 12 level known as the Wilson tunnel, with the necessary counter. It follows the same seam as operated in the No. 2 mine.

The Wilson tunnel is run parallel with the No. 2 level, and after being extended a distance of 3,390 feet encountered the same dyke or intrusion as found at the face of the No. 2 level, where rock tunnels were commenced, which after being driven a distance of approximately 1,200 feet failed to find any coal, and as result were discontinued. A diamond-drill was installed at the face of the Main level, which again proved unsatisfactory, when it was decided to withdraw the equipment and discontinue all work in this section of the mine, with the exception of the heading, a small section situated on the outside of No. 1 slope to the raise near the surface croppings. The chief operations at present are being conducted to the dip of the No. 3 level by three main haulage slopes and are known as the Nos. 1, 2, and 3 slopes, and have been extended a distance of 1,100, 800, and 600 feet respectively. The face of the No. 1 slope is at present not being extended owing to the ground being faulted, heavy, and broken, making it very hard to maintain roads. The No. 2 slope is at present being extended and operating under more favourable conditions, while the pillars are being drawn from the No. 3 slope.

Generally the measures to the dip are subject to "squeeze," with the floor heaving and the roof weighing heavy on the timbers, making it hard to maintain roads. All the timbering both on the roads and working-faces are timbered with heavy framed sets.

The cars are hauled from the landings in the slopes by main-rope haulage to the No. 3 level, where they are collected and hauled from the mine to the top of the surface incline by a trolly-motor.

During the year a 7-foot double-inlet Sirocco belt-driven fan has been installed at this mine, driven by a 75 horse-power a.c. constant-speed motor, which is situated near the entrance to

the Ross or counter level, 175 feet north-west and at an elevation of 80 feet above the Wilson tunnel. This fan is cased with hollow bricks or tiles and steel, provided with reversible doors and protected with light explosion-walls and steel doors which form part of the air-course from the mine; it is built at right angles to the entrance to the counter level and is capable of giving 100,000 cubic feet of air against a 3-inch water gauge. It is not at present being run to its full capacity. The motor is 3-phase, 60 cycles; speed 1,170 r.p.m.; volts 550; flow of current 47 amperes, geared to fan by a belt which is at present running at a speed of 1[illegible] r.p.m.

During my last inspection of this mine ventilation measured showed 20,000 cubic feet of air a minute passing into this mine, divided into four splits. The Heading split passing 14,700 cubic feet of air a minute for the use of fourteen men; Burrell test in return 0.6. The No. 1 slope split passing 14,000 cubic feet of air a minute for the use of thirty-four men. Burrell test in return showed 0.2 of 1 per cent. The No. 2 slope split was passing 1,800 cubic feet of air a minute for the use of fourteen men; Burrell test in return nil. The No. 3 slope split passing 5,000 cubic feet of air a minute for the use of seventeen men. Burrell test in return nil.

I found a ½-inch gas-cap showing on the inside of the No. 3 Right level. No. 1 slope (closed off); also a small gas-cap showing at the face of the No. 4 Right dip slope off No. 1 Main slope. The rest of the working-places, roads, and airways were free from explosive gas and a good current of air passing around them, while the doors, stoppings and brattice I found to be in good order. The roads were well timbered and in fairly good condition and, being naturally damp, were free from dangerous coal-dust, while the working places were well timbered and in good condition and a sufficient supply of suitable timber was provided for the use of the workmen.

Development.

There is very little development-work at present in the No. 3 mine, where the pillars are in close proximity to the inside of the Main level and the No. 3 slope are being drawn. The face of the No. 2 slope is at present being extended in favourable ground and very free from faulting, which may open up a new field of coal, but at present is an unknown quantity.

During the latter part of the year preparation was being made to open up a new mine 1½ miles west of the present openings, on the opposite side of the fault which is showing at the face of the No. 3 mine main level, where the coal-seam is found to be exposed and dipping into the side of the hill on the North fork of Granite creek and is known as the [illegible] showings. A small staff of men is at present engaged driving an 8 by 12 level into the side of the hill below the showings and is expected to intersect the coal-seam at a distance of about 200 feet from the entrance. This work will necessitate grading and following the contour of the hill a distance of 1½ miles, with a surface incline from the grade to the entrance to the mine.

Plant and Equipment.

The power plant of this colliery is situated 4 miles from the mine and at the town of Coalmont, which consists of two 250-horse-power water-tube boilers which generate power for driving a 600-horse-power cross-compound Corliss engine coupled direct to a 60-k.w. 3-phase revolving alternator, 550 volts, 480 amperes, running at a speed of 120 r.p.m. This power is distributed for light and power purposes both for the town and the tipple, while a portion is transformed to 10,000 volts and transmitted to the mine by high-tension wires, where it is again reduced to 550 volts for power purposes at the mine. Two Jenckes return-tube boilers are used at the mine for driving a steam-driven compressor, heating the machine-shops, running house, offices, etc., at the mine.

There has been very little change made at this plant during the present year. The overhead tramway has been operated very successfully and very little time has been lost during the early part of the year the running-cable of the tramway was showing pronounced signs of wear, which was discarded and replaced during the month of June by a new 1¼-inch flat-strand cable 30,585 feet in length, which appears to be giving satisfactory service.

Edison electric safety-lamps are in use by all the workmen underground at this colliery, while safety-lamps of the Wolf pattern are used by the officials for inspection purposes. Copies of the "Coal-mines Regulation Act" and the special rules are well posted near the entrance to the mines. A well-equipped doctor's office is provided at the mine under the charge of a first-aid officer, while the doctor is in daily attendance to give treatment to any of the employees requiring the same.

The following are the official returns from the Coalmont Colliery for the year ended December 31st, 1923:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL. Tons.	Tons.	COKE. Tons.	Tons.
Sold for consumption in Canada	77,992			
" export to United States	45,684			
" " other countries				
Total sales		123,676		
Used in making coke				
Used under colliery boilers, etc.		7,156		
Total for colliery use				
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		130,832		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND. No. employed.	Average Daily Wage.	ABOVE GROUND. No. employed.	Average Daily Wage.	TOTALS. No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	9	6.69	9	6.45	18	6.57
Whites—Miners	95	9.00			95	9.00
Miners' helpers						
Labourers	51	5.00	51	4.50	102	4.75
Mechanics and skilled labour	1	6.00	14	5.49	15	5.52
Boys	1	4.00	3	4.33	4	4.25
Japanese						
Chinese			1	3.08	1	3.08
Indians						
Totals	157	7.51½	78	4.37	235	6.64

Name of seams or pits—Nos. 2 (now closed), 3, and 4 mines.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 2 mine in upper seam (now closed); No. 3 mine in upper seam, Nos. 1, 2, and 3 slopes, also No. 1 heading; No. 4 mine, driving in direction of full pitch, will strike the coal at 300 feet.

Description and length of tramway, plant, etc.—Tram in No. 3 mine, including yard, 4,800 feet long; tram in No. 1 slope, 984 feet long; tram in No. 2 slope, 800 feet long; tram in No. 3 slope, 300 feet long; tram in No. 1 heading, 500 feet long; aerial tram, 15,110 feet long. No new equipment in mine other than rails, pipes, etc. Small compressor installed on tram as brake, power thus generated being used for kicker and lift. One 6-ton Canadian Westinghouse Company electric locomotive.

Princeton Coal and Land Company, Ltd.

Head Office—15 Great St. Helens, London, E.C.

Capital, $1,000,000

Officers.	
A. M. Townsend, Chairman.	London, England
E. S. Neave, Secretary.	London, England
Francis Glover, General Manager.	Princeton, B.C.

Value of plant $77,000

PRINCETON COLLIERY.

Francis Glover, Manager.

This colliery is situated near the town of Princeton, on the right bank of the Similkameen river, near its junction with the Tulameen, and is situated in the Similkameen Mining Division.

PRINCETON No. 1 MINE.

William James, Overman; John Liddle and Frank Lister, Fireboss.

This mine is situated half a mile east of the town of Princeton and is not only the oldest working-mine, but contains the chief developments done on this property, which have been fairly extensive, and has been developed from the surface by 12 per cent. slopes driven directly with the dip of the coal-seam, which after passing through glacial drift is reached at a distance of 300 feet from the portal; it has an average thickness of 20 feet and has been developed on the pillar-and-stall system, work being generally confined to the upper 10 feet of the seam.

Spontaneous action in the gobs and old disused workings have been a serious and constant source of trouble at this mine for a number of years, which made it practically impossible to carry out any development-work, and as a result has been chiefly confined to the extraction of pillars. However, with the object of extending the life of the mine operations were commenced in the lower portion of the seam during the present year with very unfavourable results owing to the soft nature of the floor and the roof breaking and weighting heavy on the timbers, making it hard to maintain roads, and as a result it was decided to withdraw. Pillar operations are being conducted in the upper section of the seam in the top slope pillars in close proximity to the surface croppings, making the life of this mine very limited.

Ventilation is produced by a small single inlet belt-driven fan of the Sirocco type situated near the entrance to the counter-slope, and during my last inspection ventilation measured showed 3,000 cubic feet of air a minute passing into this mine for the use of the men, and was well conducted around the working faces. Burrel gas detector tested.

The working-places were well timbered and a sufficient supply of suitable timber was provided for the use of the workmen. The roads were in good condition and being naturally dusty were free from dangerous coal dust.

No. 2 MINE.

This mine is situated 1,200 feet southeast of the entrance to No. 1 mine and is operating in the No. 1 seam of this property, with a fault separating the two mines on the west side of No. 2.

This mine is developed from the surface by an S to 12 slope driven through 300 feet of surface drift to the coal-seam and is used as the main haulage slope, which has been extended a distance of 900 feet and is connected by a crosscut to the upper portion of the old No. 2 main slope, which is being used as the return airway.

The No. 1 seam in this mine has an average thickness of from 6 to 8 feet and is lying at an inclination of 8°, and all operations are being conducted on the east side of the slope. The seam is generally overlaid with a sand rock roof and a shale floor and is at present subject to rolls in the roof and minor faulting, and may be at present considered more or less as a [illegible]

The coal is mined by compressed-air machines of the post-puncher type in the lower portion of the seam, and little blasting is required, all the shots being fired under the supervision of certified officials.

During my last visit of inspection ventilation measured showed 2,700 cubic feet of air a minute passing into this mine for the use of eleven men (produced naturally). Barometer, 27.8 inches; thermometer, 46° F.; Burrell gas-detector test in the return, 0.2 of 1 per cent. methane.

The working-places were fairly well timbered and a sufficient supply of suitable timber was provided for the use of the workmen. The roads were well timbered and in fairly good condition and, naturally damp, were free from dangerous coal-dust.

Compressed air is used for power purposes at this mine, which is transmitted through a 4-inch pipe-line from the No. 1 mine air-compressor and is used driving the surface hoist and coal-cutting machines, while the surface mine-track is connected to No. 1 mine tipple.

New Prospect.

During the year this company has leased a block of coal land situated on Finlay creek, which is situated 6 miles south-west of the town of Princeton and 1½ miles east of the Kettle Valley Railway, where an unusually thick showing of high-grade lignitic coal is found at the surface in the creek-bed, having an approximate thickness of 80 feet, lying at an angle of 60° and pitching into the side of the hill. There has been a fair amount of cross-tunnelling done on this property by local miners some years ago to prove up this body of coal, which found a ready local market.

During the latter part of the year a staff of employees has been employed grading and improving the road into this property, hauling in the necessary equipment, and the erecting of small coal chutes and bunkers; at present the coal is being hauled to the No. 1 mine tipple at Princeton by horse-sleighs, while work will be done of an exploratory nature at this property to prove this field.

Plant and Equipment.

Edison electric safety-lamps are used by the workmen at the Nos. 1 and 2 mines, while safety-lamps of the Wolf type are used by the officials for inspection purposes. Explosives of the permitted class are used for blasting and all shots are fired by electric batteries under the supervision of certified shotfirers.

There has been no change made at the surface equipment during the year, which consists of a wood tipple situated near the entrance to the No. 1 mine and is provided with a rotary dump. The coal is dumped upon a stationary 2-inch screen, from which the larger coal is cleaned and loaded into box cars, the smaller falling upon a hanging shaking screen with a ¾-inch mesh, where the larger portion of these screenings are collected by a belt-conveyor and dumped into a chute which is connected to a railway-car.

The power plant consists of three return-tube boilers having an aggregate capacity of 200 horse-power, which supply power for the mine-fan, tipple engines, No. 1 slope hoist, and a Canadian Rand air-compressor having a capacity of 750 feet of free air a minute, which is used for driving mine-hoists, mining-machines, pumps, etc.

Well-equipped machine, car-repairing, and carpenter shops and wash and change room are maintained, while a 30,000-gallon water-tank provides storage-water for the use of the plant and fire-protection purposes.

Copies of the "Coal-mines Regulation Act" and special rules are well posted near the entrance to the mine.

The following are the official returns from the Princeton Colliery for the year ended December 31st, 1923:—

SALES AND OUTPUT FOR YEAR	[illegible]	[illegible]	[illegible]	[illegible]
(Tons of 2,240 lbs.)	Tons	Tons	Tons	Tons
Sold for consumption in Canada	13,950			
" export to United States	770			
" " other countries				
Total sales		14,720		
Used in making coke				
" under colliery boilers, etc.	2,012			
Total for colliery use		2,012		
		16,732		
Stocks on hand first of year	100			
" last of year	13			
Difference taken from stock during year		87		
Output of colliery for year		16,645		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Underground		Above ground		Total	
	Number employed	Average Daily Wage	Number employed	Average Daily Wage	Number employed	Average Daily Wage
		$		$		
Supervision and clerical assistance	4	7.10, 6.00 and 5.75	3	5.77, 4.80 and 4.60	7	
Whites—Miners	10	6.00			10	
Miners' helpers	11	4.75			11	
General work	8	4.50, 4.00	9	4.00, 3.85	17	
Mechanics and skilled labour			4	4.80	4	
Boys			3	2.75, 2.25 and 1.40	3	
Japanese						
Chinese						
Indians						
Totals	33		19		52	

Name of seams or pits—Same as last year.

Description of seams, tunnels, levels, shafts, etc., and number of same. Same as last year, with the exception of some prospecting work done about 6 miles from Princeton on Finlay creek—namely, a tunnel 9 by 6 is being driven in a seam of good clean coal approximately 30 feet thick; this tunnel is now in some 100 feet.

Description and length of tramway, plant, etc.—Same as last year approximately.

EAST KOOTENAY INSPECTION DISTRICT.

REPORT BY ROBERT STRACHAN, SENIOR INSPECTOR.

I have the honour to submit the annual report covering the coal-mines in operation during the year 1923 in the East Kootenay Inspection District.

This district is directly in charge of John MacDonald, Inspector of Mines, with office in Fernie, and attached to this report is his description of the various mines in operation and the conditions which prevail in and around them.

The collieries in operation were the same as in the last few years—namely, Coal Creek and Michel, owned by the Crow's Nest Pass Coal Company, Limited, of Fernie, and Corbin, owned by the Corbin Coal and Coke Company, of Spokane.

No attempt has been made to reopen either the Morrissey Colliery, owned by the Crow's Nest Pass Coal Company, or the Hosmer Colliery, owned by the Canadian Pacific Railway Company's Natural Resources Department, and both of these collieries have been dismantled.

At Coal Creek Colliery seven mines were working during the year, one of which, No. 9, was practically exploration-work and produced very little coal, and two others, No. 1 North and No. B North, were closed down towards the end of the year.

The material has been withdrawn from these mines and the B North sealed off completely, while the Main level in the No. 1 North will likely be maintained to form at some future date an airway for No. 9 mine.

At Michel two mines were actively producing coal during the year, and the No. 3 East mine, discontinued in the early part of 1922, is simply being maintained in a state of repair without any production of coal.

At Corbin the Nos. 4 and 6 mines were in operation during the year and there was no attempt to open or reopen any of the others previously closed down.

While there has been no protracted stoppage of work owing to disputes between the employees and the companies, work has been very irregular. This irregular work was due to lack of demand for coal, caused to some extent by the replacing of coal-burning locomotives on the Great Northern Railway by oil-burners.

The following table shows the gross production of coal in long tons and the number of days worked at each colliery for 1922 and 1923:—

Colliery.	1922.		1923.	
	Coal.	Days worked.	Coal.	Days worked.
	Tons.		Tons.	
Coal Creek	291,671	150	433,836	209
Michel	216,668	158	258,429	252
Corbin	46,022	130	48,267	141
Totals	554,361	...	740,530	...

This table shows an increase in production of coal amounting to 186,169 long tons as compared with the previous year, during which it should be remembered that the mines were idle five months owing to a dispute between the workmen and the companies as to the terms of the new agreement, which will expire March 31st, 1924.

The increase of production, as well as the number of days worked, is shown in percentage in the following table:—

Colliery.	Coal Production.	Days worked.
Coal Creek	48.7	39.3
Michel	19.2	59.4
Corbin	4.0	8.4

The following table shows the amount of coal produced per underground employee yearly and daily for the years 1921, 1922, and 1923 (in long tons):—

Colliery.	1921		1922		1923	
	Year	Day	Year	Day	Year	Day
Coal Creek	588	2.80	430	2.8	776	3.7
Michel	670	3.00	553	3.3	795	3.1
Corbin	467	2.65	742	5.7	1,027	7.3

The following table shows the amount of coal produced per miner per year and per day for the years 1921, 1922, and 1923 (in long tons):—

Colliery.	1921		1922		1923	
	Year	Day	Year	Day	Year	Day
Coal Creek	1,094	5.2	823	5.4	1,456	6.[illegible]
Michel	1,117	5.0	880	5.5	1,312	[illegible]
Corbin	754	4.3	1,315	10.0	1,304	9.[illegible]

Note.—The Michel figures are rather low, owing to the No. [illegible] [illegible] for some months during the summer owing to lack of demand and maintaining the [illegible] and development work.

The amount of slack used for the production of coke was 80,764 long tons, and the coke shipments amounted to 58,919 long tons, or 1.5 tons of slack per ton of coke produced. All the coke was made in the ovens at Michel, which are of the bee-hive type, and no attempt was made to recover any of the by-products.

A plant capable of dealing with 50 tons of domestic coke was erected during the year and a growing market is being obtained for this fuel. A special number of ovens are set aside for the production of this domestic coke, and the plant consists of a Williams coal-crusher, elevators, sizing-screens, and storage-pockets, so that it can be delivered into box cars as required.

A new screen has been installed at Michel for blacksmith coal, which finds a ready market with those using forges, etc.

Accidents.

Sixteen accidents were reported to this office during the year, as compared with ten during the previous year, involving serious injury to the same number of workmen.

It is a pleasure to be able to report that no fatal accident occurred during the year, the first time that we have been able to report freedom from fatalities since 1900 or in twenty-three years. The accidents, according to collieries, consisted of eight at Coal Creek, seven at Michel, and one at Corbin.

Two of these accidents occurred outside the mine and fourteen inside. Eight of these accidents were due to falls of roof, sides, or coal; six to haulage; one to fragments of coal flying from a shot; and one to timber while it was being unloaded.

The two accidents reported as occurring outside were both due to haulage, in the case the workman getting his leg between two cars, the other falling off a steam-locomotive while in motion. The other haulage accidents consisted of a man being flung against the side of the roadway owing to breakage of rope; arm caught between car and post; foot caught between guide-rail and track-rail; and another man got his leg caught between rope and post while lowering a loaded car.

The accidents due to falls of roof, sides, or coal were divided between Michel and Coal Creek equally, four at each; in some of these cases, especially at Coal Creek, these were due to movements of the overhead strata, or what is locally termed "bumps." The number of accidents due to this cause shows an increase from three to eight as compared with the previous year, and indicates more vigilance on the part of both the miner and the officials, especially at the working-faces, is required.

In the case of the other two accidents, one was due to a piece of coal projected from a shot, showing that more care should be taken to see that the workmen are in a place of safety before a shot is fired, while the other accident occurred while unloading a car of timber in the mine, and seems another case where a little care on the part of the workman would avoid such accidents.

Attached to this report is a table showing output of coal, persons employed, deaths by accident, and death-rate per thousand employees and per million tons raised for the past eleven years, or from 1913 to 1923, inclusive.

Considering the irregularity of employment during the year, with its tendency to a lessening of discipline and fostering a less careful attitude of mind on the part of the employees, the freedom from fatal accidents reflects great credit on the part of both the workmen and the officials around the collieries.

VENTILATION.

The general conditions of the mines with respect to ventilation are dealt with in the report of John MacDonald, Inspector of Mines, which is attached, and shows the conditions to be fairly good.

As in former years, advantage was taken of the kind offer of the Dominion Department of Mines to analyse samples of the mine-air, and 193 samples were taken and forwarded to Ottawa for analysis. Of these, fifty were lost either in transit or through improper handling before reaching the laboratory, and 143 results were received.

Of the samples taken, 138 were taken at Coal Creek, forty-seven at Michel, and eight at Corbin; 174 were taken in the mine-air currents and nineteen were special samples taken from blow-outs of methane or to determine conditions where heating was suspected.

The tabulated results of the tests show in a great many cases an increase in the methane contents of the air-currents, even although in many cases an increase is also shown in the amount of air in circulation. This condition, as compared with the previous year, would indicate that the long period of unemployment during 1922 was the reason for the lower percentages recorded during that year, and, on the other hand, during 1923 the greater production of coal, even although the periods of work were interrupted by small intervals, maintained a high percentage of methane in the air-currents.

COAL CREEK COLLIERY.

In No. 1 East mine all the ventilation currents show an increase in methane percentage except the West split, and all of the air-currents show an increase in the amount of ventilation. Including the main return, the average of all the methane percentages show 1.07 per cent.

In the case of No. 3 mine all the splits as well as the main return show an increase in percentage of methane and an increase in the amount of air being circulated. The average percentage of methane in the air-currents, including the main return, shows 1.08 and is the highest average recorded in any mine of the district.

No. 2 mine shows a decrease in the methane percentage in all the districts, and in the main return and Rock tunnel show a decrease in the amount of air being circulated, while the High Line split shows a slight increase. The average percentage of methane in this mine is 0.43

In No. B North mine the main return and No. 2 split show an increase in methane, No. 1 split a decrease, while all the divisions show an increase in the amount of air being circulated. In the No. 1 split in this mine blowers of methane were met, from which explosive gas was being given off under great pressure. The average percentage of methane for all the divisions in this mine showed 1.02.

In No. 1 South mine all the divisions showed an increase in methane, while only No. 2 split showed an increase in ventilation; the other two divisions a decrease. The average percentage of methane for all the divisions was 1.06.

In No. 1 North mine and No. 9 both showed a decrease in methane percentage, No. 1 North showing an increase in ventilation, No. 9 remaining the same as last year. The average percentage of methane in No. 1 North was 0.14; in No. 9 mine, 0.23.

No. B North and No. 1 North were abandoned at the end of the year, although a portion of the No. 1 North main level may be maintained as a portion of the airway connected with No. 9 mine.

Michel Colliery

In the No. 3 East mine no coal has been produced for over a year. Three to four workmen have been employed maintaining the roadways and the ventilation has been carefully maintained. In all the divisions there has been a decrease in the methane percentage and a decrease in the ventilation, and I think indicates the source of the methane is gradually getting weaker owing to there being no development of fresh ground. The average percentage of methane for all the divisions is 0.94, and, notwithstanding that the mine has been idle so long, is the highest percentage recorded in the Michel mines.

In No. 3 mine the main return shows a slight increase in methane, while the two splits show a decrease, and all the divisions show an increase in ventilation; the average percentage for all divisions being 0.42 per cent. of methane.

In No. 8 mine the main return shows a slight increase both in methane and ventilation, while the average for all the divisions is 0.35 per cent. of methane.

Corbin Colliery.

In both the mines at Corbin, No. 4 and No. 6, the percentage of methane is very low; in the case of No. 4 it equals 0.13 per cent. and in No. 6 runs as low as 0.04 per cent.

The following table shows the amount of methane given off at each colliery during the twenty-four hours for the year 1920 to 1923, inclusive, in cubic feet:—

Colliery.	1920	1921	1922	1923
Coal Creek	5,158,080	3,523,368	2,202,204	3,920,160
Michel	2,567,520	2,821,680	2,845,755	1,005,121
Corbin	37,440	126,000	No record	46,080
Totals	7,725,600	6,354,048	5,048,049	5,871,361

If we assume a temperature of 60° F., barometer 26 inches, and the specific gravity of methane at 0.557, the weight of methane produced during the twenty-four hours in the coal mines of this district equals 108.85 short tons.

During the year a new fan of the Jeffrey double-inlet reversible type was installed at No. 8 mine, Michel, 8 feet diameter by 3½ feet wide, with a capacity of 100,000 cubic feet of air a minute, with a 3-inch water-gauge.

The new fan at No. 1 East, Coal Creek, although ready to commence operations, has not been used owing to shortage of electrical power.

Coal-dust.

The mines have been kept fairly clear from coal-dust during the year, some of this being loaded out of the mine; portions of the roadways are treated with flue-dust, but the principal method of dealing with this danger is by sprinkling water on the roadways, the sides, and the roof. Care is taken to prevent accumulations of dust, either on the floor, the timbers, or on the sides, and pipes are used throughout the mine to convey water, which is turned on the roadways with a hose-pipe. In some of the main roads automatic sprinklers are in use, and these throw a fine spray into the air-current, which carries it a long distance permeating every crevice.

No attempt has yet been made to sample the dust, and I think that some method of doing so over specified areas would be a great advantage in determining the conditions of the roadways in this respect.

Bumps and Blow-outs.

During the year nine bumps were reported, all in the mines on the south side of the valley at Coal Creek; in many cases very little damage was reported, and the heaviest, which occurred in the No. 3 mine, stopped the ventilation for a short time, and it took two and a half months to repair the damage.

Six blow-outs of methane and coal were reported as occurring during the year, projecting from 20 to 80 tons of coal-dust. These all occurred in the No. 1 East mine at Coal Creek, and fortunately without serious results.

The work of drilling the working-faces where certain indications point to a likelihood of such occurring still continues with satisfactory results. This work has no doubt not only reduced the number of blow-outs, but has minimized the results of them when they do occur, and explains to some extent the reason that no serious results have come from this source of danger.

Inspection on behalf of the Workmen.

Section 91, Rule 37, "Coal-mines Regulation Act," has been taken advantage of by the workmen at all the mines where active operations are being carried on, except at Corbin, where no inspections have been made.

This inspection is of great assistance to us, as well as to the workmen and the management, in maintaining the conditions in the mine good, and we wish to congratulate the workmen for the regularity of the inspection and the interest taken in it.

At Coal Creek this inspection was made eighty-seven times in six mines; at Michel sixteen times in Nos. 3 and 8 mines; there being no inspection in No. 9 mine at Coal Creek or No. 3 East at Michel, both of which are practically doing repair-work.

Contraventions of the "Coal-mines Regulation Act" or Special Rules.

There were no prosecutions during the year under this heading, and four general searches for articles contrary to the Act were made at Coal Creek, one of which was on the afternoon shift and thirteen searches at Michel. The fact that neither matches, pipes, nor articles contrary to Rule 9 were found reflects great credit on the workers employed.

Haulage.

The haulage in the various mines is either by compressed-air or steam hoists, the latter being situated outside the mine, endless ropes or compressed-air locomotives. The cars are gathered from the various working-faces to the landings by horses, a great many of which are employed both inside and outside the mine.

Lighting.

Practically all the workmen engaged in the mines use the Edison electric mine safety-lamp, and the only other lamp in use is the Wolf, which is used by the officials as a means of making a rapid determination of the mine-air with respect to the presence of methane.

The Burrell gas-detector is used at all the mines for making a determination of lower percentages of methane than can ordinarily be detected by the Wolf safety-lamp, as required by Rule 4, section 91, of the "Coal-mines Regulation Act."

At Coal Creek Colliery a graph is maintained showing the methane percentage in each split or airway as determined by the Burrell gas-detector, checked by the analysis taken, the barometrical reading, and the measurement of air-current taken each week. The following table shows the number and kind of lamps in use:—

Colliery.	Electric.	Oil.	Total.
Coal Creek	639	76	715
Michel	380	24	404
Corbin	62	18	70
Totals	1,081	118	1,180

All the electric lamps are of the Edison mine safety type and are locked by a spring; the Wolf safety-lamps are locked by a magnetic lock.

Explosives.

The total amount of explosives used at the collieries in the district amounted to 21,492 lb., or 10.746 tons. The amount of shots fired was 31,853, all of which were fired by electric detonator and battery.

The number of miss-fires was seventy-nine, all of which occurred in the Michel Colliery. Polar Permitite is used for rock-work and Monobel for breaking down coal.

The following table shows the quantity of explosives used in pounds number of shots fired amount of explosives per shot, and the kind of work the explosive was used for

Colliery	Explosives	Shots fired	Pounds per shot	Kind of work
	Lbs.		Lbs.	
Coal Creek	1,380	1,860	0.76	Rock
Michel	2,935	3,261	0.90	Rock
Michel	14,610	24,023	0.60	Coal
Corbin	2,367	2,567	0.92	Coal
Totals	21,492	31,853		

No explosives were used for the production of coal at Coal Creek Colliery and the amount of coal produced per shot and per pound of explosives is shown in the following table

Colliery	Explosives	Shots fired	Coal Produced in Long Tons	
			Per Shot	Per Pound of Explosive
	Lbs.			
Coal Creek				
Michel	14,610	24,023	10.7	17.6
Corbin	2,367	2,567	17.4	18.8

While the use of explosives for breaking down coal is permitted in Michel and Corbin Collieries, it should be understood that every precaution should be taken to prevent accidents. Strict supervision with respect to the presence of methane, dust, and the placing of the shots should be exercised, and attention is specially directed that in no case should a second hole be drilled until the first hole is blasted and the place inspected. It should be kept in mind that it is very difficult to accurately determine the position of a second drill hole until it is known what work the first hole or shot has accomplished.

COAL-CUTTING MACHINES.

Only one coal-cutting machine was in use during the year, and this was in Michel where a machine of the Hardy post type was in use and produced 6000 tons of coal.

MINE-RESCUE AND FIRST AID TO THE INJURED.

The past year seems to have been quiet in first aid work, there being no classes held either at Coal Creek or Fernie; one made up of nineteen pupils was conducted at Michel and some at Corbin. Probably the decision of the Canadian Branch of the St. John Ambulance Association not to hold any contests during the year and change the time of the contest from the fall to the spring may have had an influence in bringing about this decision.

The work has been pretty well sustained during the year and a team from both Coal Creek and Michel took part in the first aid contest held at Blairmore under the auspices of the Rocky Mountain Branch of the Canadian Institute of Mining and Metallurgy. Later at the contest held in Michel under the auspices of the East Kootenay Mine Safety Association there were three teams representing Coal Creek and two representing Michel along with two from Alberta in the contest. At this contest the team captained by Mr. Hesketh of Bellevue secured first place; the Michel team, captained by Mr. Fowler second place, and Bellevue Colliery team third place.

The work of mine-rescue was very well maintained during the year, thirty workmen or officials taking a course of training or retraining at Coal Creek and seven at Michel. No men took training at Corbin, the reason being lack of suitable apparatus and also lack of sufficient number of apparatus to equip a team.

At the annual mine-rescue and first aid meet held at Blairmore, Alberta, under the auspices of the Rocky Mountain Branch of the Canadian Institute of Mining and Metallurgy, three teams

represented Coal Creek Colliery and one represented Michel. The Michel team, captained by Mr. Howden, tied for first place with the Hy-Grade team from Drumheller; third place going to the Coal Creek team, captained by Mr. Hynds; fourth and sixth places going to the other two Coal Creek teams, out of a field of twelve teams.

At the annual competition held at Michel under the auspices of the East Kootenay Mine Safety Association three teams from Coal Creek took part, two from Michel, one from Bellevue, and one from Lethbridge. Coal Creek team, captained by John Caufield, took first place, incidentally bringing back to British Columbia the shield presented by the Hon. J. H. King, Minister of Public Works, the previous year; second place went to the Michel team, captained by Mr. Littler; third place to Coal Creek team, captained by Mr. Hesketh; and fourth place to Michel team, captained by Mr. Howden. As the winners in this competition in mine-rescue work, John Caufield's team took part in the annual competition held under the auspices of the Vancouver Island Mine Safety Association, losing first place by one-half of 1 per cent. after a very keen contest.

In both first aid to the injured and mine-rescue work it is to be regretted that the average workman employed in and around the mine does not take more interest. The general idea seems to prevail that this work should be undertaken by the officials, although it would seem more a duty owed by one workman to another.

The difficulty in preventing accidents makes the work of first aid and mine-rescue all the more important, and I trust that the time is not far distant when every able-bodied man engaged in and around the mine should take an active interest in any work that tends to prevent accidents, or reduce the amount of human suffering when such accidents, unfortunately, do occur.

The equipment of mine-rescue apparatus remains practically the same as in previous years and are kept in very good condition. The Draeger apparatus at Michel has almost outlived its usefulness and should be replaced with some more up-to-date type, and at Corbin the apparatus is not only out of date, but the number of apparatus maintained is not sufficient to equip a team, making it not only difficult to practise, but impossible to use with safety in the event of it being required.

At the Department Mine-rescue Station maintained at Fernie the apparatus is kept in fairly good condition, with an ample supply of regenerators and oxygen, but I should like to see only one type at the station instead of two. Different types of apparatus, besides requiring the maintenance of a double supply of spare parts, is very liable to lead to confusion in the event of an emergency, a condition which should be avoided at all costs.

We again wish to thank the workmen and officials for their assistance in carrying out our duties during the past year, and look forward to a continuation of the same in the year we are now entering upon, 1924, realizing more and more that it is only through the combined efforts of all parties that we can expect a reduction in our list of accidents and make the industry of mining a safer and more pleasant occupation.

Attached is a list of the accidents reported to this office during the year 1923, a brief description of the various mines and the conditions that exist therein, and the annual returns from the various collieries for the year ended December 31st, 1923.

REPORTS BY JOHN MACDONALD, INSPECTOR.

Crow's Nest Pass Coal Company, Ltd.

Capital, $3,500,000.

Officers.	*Address.*
W. R. Wilson, President,	Fernie, B.C.
H. B. McGiverin, Vice-President,	Ottawa, Ont.
J. S. Irvine, Secretary,	Fernie, B.C.
A. A. Klauer, Treasurer,	Fernie, B.C.
W. R. Wilson, General Manager,	Fernie, B.C.
Bernard Caufield, Colliery Manager, Coal Creek Collieries,	Fernie, B.C.
Robert Bonar, Colliery Manager, Michel Collieries,	Michel, B.C.

The above company is now operating the following extensive collieries on the western slope of the Rocky mountains in the East Kootenay District, namely:—

Coal Creek Colliery, situated on Coal creek, about 5 miles from the town of Fernie on a branch railway to the mines, connected at Fernie with the tracks of the Canadian Pacific Railway and also those of the Great Northern Railway.

Michel Colliery, situated on both sides of Michel creek, on the line of the Canadian Pacific Railway, being 23 miles in a north-easterly direction from Fernie.

The amount and disposition of this combined output of the company's collieries is fully shown in the following table:—

COMBINED RETURNS FROM CROW'S NEST PASS COAL CO.'S MINES FOR YEAR 1923.

SALES AND OUTPUT FOR YEAR	[illegible]	[illegible]	[illegible]	[illegible]
(Tons of 2,240 lb.)	Tons	Tons	Tons	Tons
Sold for consumption in Canada	228,700		34,818	
" export to United States	318,070		23,564	
" " other countries				
Total sales		546,909		58,382
Used in making coke	89,761			
Used under colliery boilers, etc.	55,001			
Total for colliery use		144,762		
Stocks on hand first of year	112		127	
" last of year	743		774	
Difference added to stock during year		63		537
Output of colliery for year		691,363		58,919

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR	[illegible]		[illegible]		Totals	
	No. employed	Average Daily Wage	No. employed	Average Daily Wage	No. employed	Average Daily Wage
Supervision and clerical assistance	38		27		65	
Whites—Miners	512				512	
Miners' helpers						
Labourers	101		217		318	
Mechanics and skilled labour	218		172		390	
Boys	12		9		21	
Japanese						
Chinese—Labourers			4		4	
Indians						
Totals	911		441		1,352	

COAL CREEK COLLIERY

Bernard Caufield, Manager. Jas. Taylor, Assistant Manager.

This colliery, the mines of which are located on both sides of Coal creek, is situated about 5 miles from Fernie, where it has railway connections with the Canadian Pacific and Great Northern Railways by means of a branch line called the Morrissey, Fernie & Michel Railway.

The mines in continuous operation during the year were No. 1 East, No. 2, No. 3, and No. 1 South on the south side of the valley, and No. 9 on the north side, while coal production ceased

in No. 1 North and No. B North on June 20th and November 8th respectively. All the material has since been removed from the two latter mines, and, with the exception of some timbering at the outby end of the main tunnels, all work was practically finished in these mines at the end of the present year.

A general description of the surface plant, methods of working, and system of haulage around the mines has appeared in previous Reports of the Minister of Mines.

The lamp used exclusively by the workmen is the Edison electric cap safety-lamp, while Wolf safety-lamps are used by the officials and bratticemen for testing purposes. All lamps are cleaned and repaired in a well-equipped lamp-room located in a central position at the colliery.

A large number of houses are provided at Coal Creek for those who prefer to live close to the mines, while a good train service is maintained with the town of Fernie, where the majority of the workmen reside.

Copies of the "Coal-mines Regulation Act" and special rules are posted up at all the mines.

Following is a brief description of the conditions generally prevailing in the mines throughout the year:—

No. 1 East Mine.

J. Caufield, Overman; H. Dunlap, J. Duncan, J. Maltman, and T. Reid, Firebosses.

This mine operates the eastern portion of the No. 1 seam, which is reached by a crosscut tunnel at a distance of 215 feet from the entrance. It is ventilated by a 16- by 8-foot Wilson fan, which produces an average quantity of 130,200 cubic feet of air a minute, under a water-gauge of 3.6 inches.

This mine is divided into four separate splits, the quantity passing in each at the last inspection measuring as follows:—Main return, 1,300 by 104: 135,200 cubic feet of air a minute for the use of 101 men and sixteen horses; Burrell gas-detector, no reading taken. West split, 220 by 60: 13,200 cubic feet of air a minute for the use of thirty men and five horses; Burrell gas-detector, 1.6 per cent. methane. First South split, 300 by 75: 22,500 cubic feet of air a minute for the use of thirty-five men and six horses; Burrell gas-detector, 1.5 per cent. methane. Second South split, 200 by 70: 14,000 cubic feet of air a minute for the use of twenty men and three horses; Burrell gas-detector, 1.35 per cent. methane. North split, 130 by 112: 14,560 cubic feet of air a minute for the use of sixteen men and two horses; Burrell gas-detector, 1 per cent. methane.

Explosive gas has been found fourteen times during the year in the course of inspection, generally in cavities in the roof above the timbers, the soft nature of the roof coal making it almost impossible to prevent the formation of such cavities.

Burrell gas-detector readings have been taken regularly in each split, these varying from 0.7 per cent. methane in the main return airway to 1.9 per cent. methane in the Second South split return airway.

Roadways and timbering have been kept in good shape, a good supply of timber provided for the use of the workmen, and the "special timbering" rules well complied with at the working-faces; while the mine generally has been kept fairly free from coal-dust by the use of spraying systems, these being operated on all roads and working-faces where required and all main roads treated periodically with second-burnt ashes.

No. 1 South Mine.

F. Landers, Overman; W. Hynds, W. Stockwell, W. Morgan, and M. Hilton, Firebosses.

This mine is situated half a mile to the west of the tipple and operates the upper and western portion of the No. 1 seam. It is ventilated by an electrically driven 8- by 4-foot Keith fan, running at a speed of 254 r.p.m., producing an average quantity of 35,400 cubic feet of air a minute, under a water-gauge of 2.8 inches.

This mine is divided into two ventilating districts; the quantities passing in each at the last inspection measured as follows:—Main return, 350 by 60: 21,000 cubic feet of air a minute for the use of seventy-five men and seventeen horses; Burrell gas-detector, 1.4 per cent. methane. No. 1 split, 130 by 90: 11,700 cubic feet of air a minute for the use of forty men and ten horses; Burrell gas-detector, 1.7 per cent. methane. No. 2 split, 120 by 90: 10,800 cubic feet of air a minute for the use of thirty-five men and seven horses; Burrell gas-detector, 0.8 per cent. methane.

Explosive gas has been found nine times in the course of inspection, while readings taken regularly with the Burrell gas-detector have varied from 0.2 per cent. methane in the No. 2 split to 2 per cent. methane in the No. 1 split.

Roadways and timbering have been kept in fairly good shape, a good supply of timber provided for the use of the workmen, while the requirements of the "systematic timbering" rules have been fairly well attended to at the working faces. Spraying systems are operated on all roads and working-places where required, while all main roads are treated regularly with second-burnt ashes.

No. 1 North Mine.

J. Worthington, Overman; Ed. Rutledge, J. Charnock, and H. Parsons, Firebosses.

This mine was operating the western portion of the No. 1 seam on the north side of the valley until June 20th of the present year, on which date coal production ceased with the exception of what was produced from the driving of a slope in the direction of No. 9 mine. This was put down a distance of 150 feet, at which point it was decided to discontinue further development in this direction; all efforts were then concentrated on getting out the material, this being accomplished toward the latter end of December.

Ventilation was produced by an electrically driven 7 by 4 foot Keith fan, running at a speed of 200 r.p.m., giving an average quantity of 24,700 cubic feet of air a minute under a water-gauge of 1.7 inches.

This mine was all on one split; ventilating conditions during the year were good, while roadways and timbering were kept in good shape and the provisions of the special rules re timbering well carried out at the working-faces.

Explosive gas was found once in the course of inspection, while the percentage of methane in the return air-current did not exceed 0.5 per cent. Being naturally damp, the roadways were generally free from coal-dust.

No. 9 Mine.

R. Fowler, Fireboss.

This mine operates the No. 2 seam on the north side of the valley. No further development work has been done in the Main level; the main object at the present time is to make a connection with No. 1 North mine by means of a pair of companion inclines now driving up from the Main level.

Ventilation is produced by a fan of the Guibal type, running at a speed of 60 r.p.m., which gives an average quantity of 8,200 cubic feet of air a minute under a water-gauge of 1.3 inches. At the last inspection the quantity passing measured as follows:—Main return, 180 by 50: 9,200 cubic feet of air a minute for the use of six men and two horses.

No trace of explosive gas was found in the course of inspection, while the percentage of methane in the return air-current has averaged 0.25 per cent.

Conditions generally have been good, roadways and timbering kept in good shape, a good supply of timber provided for the use of the workmen, and the requirements of the "systematic timbering" rules well attended to at the working faces.

No. 8 North Mine.

W. Commons, Overman; J. Whyte and E. Jones, Firebosses.

This mine operated the B seam until November 8th of this year, on which date coal production ceased and all efforts were directed to pulling the material out of the mine; this work was practically finished at the end of December.

Ventilation was produced by an electrically driven 10 by 3 foot Brazil fan, running at a speed of 150 r.p.m., giving an average quantity of 43,200 cubic feet of air a minute under a water-gauge of 1.4 inches.

The quantity passing in each district at the last inspection measured as follows:—Main return, 940 by 50: 47,000 cubic feet of air a minute for the use of twelve men and three horses; Burrell gas-detector, 0.7 per cent. methane. No. 1 split, 200 by 60: 16,800 cubic feet of air a minute for the use of two men; Burrell gas-detector, 0.5 per cent. methane. No. 2 split, 320 by 60: 19,200 cubic feet of air a minute for the use of ten men and two horses; Burrell gas-detector, 1.4 per cent. methane.

Explosive gas was found six times during the year in the course of inspection, while the percentage of methane in the return air-currents as determined by the Burrell gas-detector varied from 0.5 per cent. in the No. 1 split to 1.7 per cent. in the No. 2 split.

Conditions in general have been good, roadways and timbering kept in good shape and fairly free from coal-dust, spraying systems being operated on all roads and working-places where required. A good supply of timber was provided for the use of the workmen and the requirements of the "systematic timbering" rules fairly well attended to at the working-faces.

No. 3 Mine.

J. Biggs, Overman; R. Phillips, W. Brown, and E. Caufield, Firebosses.

This mine operates the eastern and dip portion of the No. 2 seam and is ventilated by a 16- by 8-foot Wilson fan, which, running at a speed of 146 r.p.m., produced an average quantity of 55,570 cubic feet of air a minute, under a water-gauge of 3.6 inches.

The quantities passing in each district at the last inspection measured as follows:—Main return, 900 by 60: 54,000 cubic feet of air a minute for the use of fifty-eight men and nine horses; Burrell gas-detector, 1 per cent. methane. Incline split, 100 by 80: 8,000 cubic feet of air a minute for the use of eight men and one horse; Burrell gas-detector, 0.6 per cent. methane. South split, 570 by 60: 34,200 cubic feet of air a minute for the use of fifty men and eight horses; Burrell gas-detector, 1.1 per cent. methane.

Explosive gas has only been found once in the course of inspection; on this occasion in a cavity in the roof in the Main level while crossing over a fault; while the percentage of methane in the return air-currents, as determined by the Burrell gas-detector, has varied from 0.3 per cent. in the Incline split to 1.9 per cent. in the South split.

Conditions generally have been good throughout the year, roadways and timbering kept in good shape, a good supply of suitable timber provided for the use of the workmen, and the requirements of the "systematic timbering" rules well attended to at the working-faces. Spraying systems are operated on all roads and working-places where required, while all main roads are treated regularly with second-burnt ashes.

No. 2 Mine.

C. McNay, Overman; J. Bushell, W. Clarkstone, and E. Ward, Firebosses.

This mine operates the western portion of the No. 2 seam, being situated on the same level as the tipple, to which the loaded cars are delivered direct by compressed-air locomotive. It is ventilated by a 16- by 8-foot Wilson fan, running at a speed of 132 r.p.m., producing an average quantity of 35,700 cubic feet of air a minute, under a water-gauge of 3 inches.

It is divided into two ventilating districts; the quantity passing in each at the last inspection measured as follows:—Main return, 420 by 75: 31,500 cubic feet of air a minute for the use of seventy-eight men and eleven horses; Burrell gas-detector, 0.5 per cent. methane. Rock tunnel, 220 by 80: 17,600 cubic feet of air a minute for the use of fifty-five men and seven horses; Burrell gas-detector, 0.6 per cent. methane. High Line, 260 by 33: 8,580 cubic feet of air a minute for the use of twenty-three men and four horses; Burrell gas-detector, 0.2 per cent. methane.

Explosive gas was only found on one occasion during the year in the course of inspection, while the percentage of methane in the return air-currents, as determined by the Burrell gas-detector varied from 0.1 per cent. in the High Line split to 1 per cent. in the Rock Tunnel split.

Roadways and timbering have been kept in good shape, a good supply of timber provided for the use of the workmen, and the requirements of the "systematic timbering" rules fairly well attended to at the working-faces. Spraying systems are operated on all roads and working-places, while all main roads receive regular applications of second-burnt ashes.

The following are the official returns for the Coal Creek Colliery for the year ended December 31st, 1923:—

SALES AND OUTPUT FOR YEAR	[illegible]	[illegible]	[illegible]	[illegible]
(Tons of 2,240 lb.)	Tons	Tons	Tons	Tons
Sold for consumption in Canada	113,316			
" export to United States	284,264			
" " other countries				
Total sales		397,580		
Used in making coke				
Used under colliery boilers, etc.	35,625			
Total for colliery use		35,625		
		433,205		
Stocks on hand first of year	112			
" last of year	743			
Difference added to stock during year		631		
Output of colliery for year		433,836		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID ETC.

(Fernie Coke-ovens idle since April 4th, 1919.)

CHARACTER OF LABOUR.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	No. employed	Average Daily Wage	No. employed	Average Daily Wage	No. employed	Average Daily Wage
Supervision and clerical assistance	24		14		38	
Whites—Miners	304				304	
Miners' helpers						
Labourers	65		54		119	
Mechanics and skilled labour	171		104		275	
Boys	11		12		23	
Japanese						
Chinese						
Indians						
Totals	575		184		759	

Figures represent number of employees on pay roll, December 1923.

The following shows the number of days Coal Creek Colliery worked each month during the year 1923:—

January	26	August	22
February	22	September	10
March	21	October	17
April	16	November	12
May	14	December	15
June	13		
July	23	Total	220

Name of seams or pits—No. 1 North, closed down on June 23rd, 1923. No. 1 South and No. 1 East, same seam; No. B, closed down on November 8th, 1923. Nos. 2, 3 and 6 same seam.

MICHEL COLLIERY.

Robert Bonar, Manager; M. McLean, Afternoon-shift Overman.

This colliery is situated on both sides of Michel creek, 24 miles north of Fernie, and has rail connection with both the Canadian Pacific and Great Northern Railways. The whole of

the coal produced during the year has come from Nos. 3 and 8 mines, all of which came from the solid, no pillars being extracted in any of the mines.

The only work done in No. 3 East mine consisted of repairs to airways and pumping water. The Edison electric cap safety-lamp is used exclusively by the workmen, while Wolf safety-lamps are used by the officials and bratticemen for testing purposes, Burrell gas-detectors being provided for the purpose of detecting lower percentages of methane than could ordinarily be found by the Wolf safety-lamp.

A description of the methods of working, system of haulage, and surface equipment has appeared in previous Reports of the Minister of Mines; the only addition to the surface plant has been the erection of a coke-crusher for the purpose of crushing the coke into sizes suitable for domestic use. It consists of one Jeffrey 24- by 30-inch double-roll coke-sizer, reducing the coke to 4 inches and under and screened to pea, nut, stove, and egg sizes by a revolving screen. This screen is on top of the bins, which are placed between two railway-tracks and built high enough to facilitate the loading of the crushed coke into the railway-cars. The coke is elevated from the crusher to the revolving screen by a continuous-bucket elevator capable of handling 50 tons an hour.

Copies of the "Coal-mines Regulation Act" and special rules are posted up at all the mines.

Following is a brief description of the conditions generally prevailing in the various mines throughout the year:—

No. 3 Mine.

M. Littler, Overman; A. Davies, A. Frew, T. Owen, and T. James, Firebosses; J. Strachan, Shotfirer.

This mine is operating two seams, Upper No. 3 and what is termed the No. 2 seam; this lies above the Upper No. 3 seam, varies in thickness from 5 to 6 feet, has a shale roof and sandstone floor, and was opened up by means of a crosscut tunnel approximately 200 feet in length, driven from the Main East level of the first-named seam.

Ventilation is produced by a 12- by 6-foot Sullivan fan, running at a speed of 140 r.p.m., giving an average quantity of 93,200 cubic feet of air a minute, under a water-gauge of 2.2 inches.

The quantities passing in each district at the last inspection measured as follows:—Main return, 1,050 by 100: 105,000 cubic feet of air a minute for the use of ninety-four men and thirteen horses; Burrell gas-detector, 0.5 per cent. methane. East side, 210 by 170: 35,700 cubic feet of air a minute for the use of thirty-eight men and five horses; Burrell gas-detector, 0.8 per cent. methane. West side, 1,800 by 10: 18,000 cubic feet of air a minute for the use of fifty-six men and eight horses; Burrell gas-detector, 0.5 per cent. methane. No. 2 seam, 300 by 40: 12,000 cubic feet of air a minute for the use of eleven men and two horses; no Burrell reading.

Explosive gas has been found on two occasions during the year in the course of inspection, while the percentage of methane in the return air-currents, as determined by the Burrell gas-detector, has varied from 0.5 to 1 per cent. in the East Side district.

Conditions in general have been very good throughout the year, roadways and timbering kept in good shape and free from coal-dust, spraying systems being operated on all roads and working-places where required. A good supply of suitable timber has been provided for the use of the workmen and the requirements of the "systematic timbering" rules well attended to at the working-faces.

No. 8 Mine.

A. Howden, Overman; E. Ainsworth, A. Almond, R. McFegan, R. Taylor, and G. Davey, Firebosses; J. Wallbank, Shotfirer.

This mine operates the upper portion of the No. 8 seam and is ventilated by an 8- by 3½-foot double-inlet Jeffrey fan, estimated to give 160,000 cubic feet of air a minute, under a water-gauge of 3 inches. This fan was erected during the latter part of the year and is connected to an upper level by means of an air-shaft 10 feet square and 35 feet deep.

Ventilating conditions have been greatly improved since this fan was put in operation, and further improvement should result when the overcast, now under course of construction over

No. 1 incline, is finished, as this should do away with all ventilating doors on the West Side inclines.

At the present time the mine is divided into three separate splits, the quantities passing in each at the last inspection measuring as follows:—Main return, 1,850 by 64: 118,400 cubic feet of air a minute for the use of 115 men and eighteen horses; no Burrell reading. No. 1 split, 280 by 36: 10,080 cubic feet of air a minute for the use of forty-five men and ten horses; Burrell gas-detector, 0.5 per cent. methane. No. 2 split, 120 by 80: 9,600 cubic feet of air a minute for the use of twenty men and one horse; no Burrell reading. No. 3 split, 500 by 16: 8,000 cubic feet of air a minute for the use of fifty men and seven horses; Burrell gas-detector, 0.2 per cent. methane.

No trace of explosive gas has been found in the course of inspection, while the percentage of methane in the return air-currents, as determined by the Burrell gas-detector, has varied from 0.15 per cent. in the No. 1 split to 0.5 per cent. in the No. 3 split.

Roadways and timbering have been kept in good shape, a good supply of timber provided for the use of the workmen, and the requirements of the "systematic timbering" rules fairly well attended to at the working-faces. Spraying systems are maintained on all roadways and working-faces where required and the mine has been kept generally free from coal-dust.

No. 3 East Mine.

A. Ball, Fireboss.

This mine is practically stopped at present; the only work being done consists of repairs to main roads and pumping water. It is ventilated by a 16- by 8-foot Wilson fan, running at a speed of 90 r.p.m., producing an average quantity of 95,180 cubic feet of air a minute, under a water-gauge of 1.9 inches.

The quantities passing in each district at the last inspection measured as follows:—Main return, 1,600 by 63: 100,800 cubic feet of air a minute for the use of three men and one horse; Burrell gas-detector, 0.5 per cent. methane. No. 6 East split, 480 by 76: 36,480 cubic feet of air a minute for the use of three men and one horse; Burrell gas-detector, 0.9 per cent. methane. West side, 550 by 50: 27,550 cubic feet of air a minute; Burrell gas-detector, 1.9 per cent. methane.

No trace of explosive gas has been found in the course of inspection, while readings taken regularly with the Burrell gas-detector have varied from 0.5 per cent. methane in the main return to 2.2 per cent. methane in the West Side district.

Roadways and timbering have been kept in good shape and generally free from coal-dust.

The following are the official returns from the Michel Colliery for the year ended December 31st, 1923:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons	Tons	Tons	Tons
Sold for consumption in Canada	115,483		34,818	
" export to United States	33,806		23,564	
" " other countries				
Total sales		149,289		58,382
Used in making coke	89,764			
Used under colliery boilers, etc.	19,376			
Total for colliery use		109,140		
		258,429		
Stocks on hand first of year			177	
" last of year			714	
Difference added to stock during year				537
Output of colliery for year		258,429		58,919

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.
(Includes Coke-ovens.)

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	14		13		27	
Whites—Miners	208				208	
Miners' helpers						
Labourers	36		163		199	
Mechanics and skilled labour	77		68		145	
Boys	1		9		10	
Japanese						
Chinese—Cooks			4		4	
Indians						
Totals	336		257		593	

Figures represent number of men on pay-roll in December, 1923.

The following shows the number of days Michel Colliery worked each month during the year 1923:—

January	22	August	23
February	24	September	18
March	25	October	22
April	16	November	14
May	21	December	22
June	23		
July	22	Total	252

Name of seams or pits—Old No. 3 (lower section of No. 3 seam); New No. 8 (old No. 8 mine continued).

Corbin Coal and Coke Co., Ltd.

Head Office—Spokane, Wash.

Capital, $7,000,000.

Officers.	*Address.*
Rush Taggert, President,	New York, N.Y.
J. K. O. Sherwood, Vice-President,	New York, N.Y.
Wm. Weaver Heaton, Secretary-Treasurer,	New York, N.Y.
R. S. Ord, General Manager,	Spokane, Wash.
E. L. Warburton, Mine Manager,	Corbin, B.C.

Capital, $7,000,000.

E. L. Warburton, Manager.

This colliery is situated 14 miles from McGillivray Junction on the Crowsnest branch of the Canadian Pacific Railway, is reached by means of a branch line called the Eastern British Columbia Railway, and consists of the following mines: Nos. 4, 5, and 6; the whole of the present year's output coming from Nos. 4 and 6 mines.

No additions have been made to the boiler plant or surface equipment, a description of which has appeared in previous Reports of the Minister of Mines.

The Edison electric cap safety-lamp and the Wolf safety-lamp are used by the workmen, while a Burrell gas-detector is provided for the purpose of detecting lower percentages of methane than could ordinarily be found with the Wolf safety-lamp.

Copies of the "Coal-mines Regulation Act" and special rules are posted up at the colliery.

Following is a brief description of the conditions prevailing in the mines throughout the year:—

NOS. 4, 5, AND 6 MINES

W. Almond, Overman; H. Osborne, Shiftboss; J. Virgo, G. [illegible] and W. Chapman, Firebosses.

No. 4 mine is operating the No. 4 seam, all of the coal coming from the [illegible] where the pillars are extracted by the retreating caving system.

Ventilation is produced by a single-inlet fan of the Guibal type, running at a speed of [illegible] r.p.m., giving an average quantity of 24,000 cubic feet of air a minute, under a water gauge of 0.6 inch.

At the last inspection the quantity passing measured as follows: Main intake [illegible] by 35, 27,300 cubic feet of air a minute for the use of twenty-six men and three horses; no Burrell reading.

No trace of explosive gas has been found in the course of inspection; roadways and timbering kept in good shape, a good supply of timber provided for the use of the workmen, and the requirements of the "systematic timbering" rules well attended to at the working faces. This mine, being naturally damp, has been very free from coal-dust.

NO. 5 MINE

This mine has not produced any coal during the year, what little work was done consisted of repairs to the Main level.

NO. 6 MINE

All the coal produced from this mine has come from the lower district, nothing being done in the two upper levels in the way of development work.

It is ventilated by a small Sirocco fan, electrically driven, the quantity of air passing at the last inspection measured as follows: Lower district, [illegible] by 42, [illegible] cubic feet of air a minute for the use of ten men and one horse; no Burrell reading.

No trace of explosive gas was found in the course of inspection; roadways and timbering kept in good shape, a good supply of suitable timber has been provided for the use of the workmen, and the requirements of the "systematic timbering" rules very well attended to at the working-faces. As this mine is naturally wet, it has been free from coal-dust and conditions generally have been very good throughout the year.

The following are the official returns from the Corbin Colliery for the year ended December 31st, 1923:—

SALES AND OUTPUT FOR YEAR	[illegible]		[illegible]	
(Tons of 2,240 lb.)	Tons	Tons	Tons	Tons
Sold for consumption in Canada	7,997			
" export to United States	35,655			
" " other countries				
Total sales		43,652		
Used in making coke				
Used under colliery boilers, etc.	4,252			
Total for colliery use		4,252		
		47,904		
Stocks on hand first of year				
" last of year	902			
Difference added to stock during year		902		
Output of colliery for year		48,806		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	4		9		13	
Whites—Miners	24				24	
Miners' helpers	13				13	
Labourers			7		7	
Mechanics and skilled labour	5		18		23	
Boys	1		1		2	
Japanese						
Chinese						
Indians						
Totals	47		35		82	

Name of seams or pits—Nos. 4 and 6 mines operating.

Description of seams, tunnels, levels, shafts, etc., and number of same—As per last report, except that No. 6 mine development has been advanced about 300 feet on the lower level and about 100 feet development at No. 5 mine.

Description and length of tramway, plant, etc.—As per last report.

DETAILED STATEMENT OF ACCIDENTS IN B.C. COLLIERIES DURING 1923.

REPORTED BY HENRY DEVLIN, THOMAS JACKSON, AND JAS. DICKSON, INSPECTORS.

COAST COLLIERIES.

No.	Name of Colliery and Date.	Name and Occupation.	Details.
1	No. 1 mine (W.F.C.), Jan. 22	Jos. Blackburn, rock picker	Right leg torn off through slipping on top of casing covering screw conveyor and having his foot caught by screw. Fatal.
2	No. 1 mine (W.F.C.), Mar. 15	Joseph Flinn, winch boy	Lower right forearm bruised and fractured clavicle, caused by fall of coal.
3	No. 1 mine (W.F.C.), July 11	Nick Balbic, brusher-driver	Left index finger fractured when jammed between rib and car.
4	Reserve (W.F.C.), Jan. 30	Richard Jackson, miner	Fractured left ulna, caused by falling rock.
5	Reserve (W.F.C.), Feb. 20	David Cook, miner	Compound fracture of left leg, caused by falling rock.
6	Reserve (W.F.C.), Mar. 9	Wasyl Laba, miner	Compound fracture of right femur, caused by falling rock. Fatal.
7	Reserve (W.F.C.), April 4	Andrew Slater, miner	Fractured pelvis, caused when two or three pieces of falling rock broke lagging, causing the roof to fall in.
8	Reserve (W.F.C.), July 18	Sandy Fulla, miner	Broken nose and cut about the face when a large piece of rock fell on his neck, knocking his face on the rail. Subsequently died five days later.
9	Reserve (W.F.C.), Sept. 19	William Raffle, driver	Right foot slipped and rope caught his leg, causing broken tibia and fibula.
10	Reserve (W.F.C.), Oct. 13	Nicholas Venler, miner	Fractured right fibula and tibia, caused by falling rock.
11	Wakeelah (W.F.C.), Mar. 28	John J. McLellan, stableman	Two ribs broken, caused when jammed against side of stall by horse.
12	Protection (W.F.C.), May 14	James Perry, driver	Fracture of left foot, caused by having foot caught under bumper when car jumped the track.
13	Protection (W.F.C.), June 4	Albert Mortimer, driver	Fractured thigh, pelvis crushed, and internal injuries caused through being squeezed between loaded car and one of the uprights of the shaft timbers. Fatal.
14	Protection (W.F.C.), Nov. 19	James Cook, miner	Crushing injuries to right side and shoulder, side of chest, when moving rock from side of pillar large piece rolled over, knocking out three timbers and jamming Cook up against mine car. Fatal.
15	North side No. 1 mine (W.F.C.), Jan. 25	Charles Buttress, winch boy	Fractured pelvis and broken rib sustained while moving two cars of timber over the brow, when the cars took the grade and he was knocked against a post.
16	North side No. 1 mine (W.F.C.), Oct. 11	Steve Yeramovitch, brusher	Broken bone covering spine, caused by falling rock.
17	North side No. 1 mine (W.F.C.), Dec. 4	Joseph Sutton, miner	Abraded wound on forehead and left index finger, abrasion and contusion of head, shoulders and back, severe contusion of right [illegible], caused while [illegible] fell from roof.

COAST COLLIERIES—*Continued.*

No.	Name of Colliery and Date.	Name and Occupation.	Details.
18	South side, No. 1 mine (W.F.C.), April 2	Harry Pollitt, driver	Broken rib and other bruises, caused when thrown from empty car by frightened mule.
19	South side, No. 1 mine (W.F.C.), Sept. 4	James Blades, miner	Fatally injured when coal fell from side, knocking timbers out and causing the roof to fall in.
20	South side, No. 1 mine (W.F.C.), Sept. 4	Geo. Morgan, miner	Fatally injured when coal fell from side, knocking timbers out and causing the roof to fall in.
21	Explosion at No. 4 mine, Comox, Feb. 8	Leung Toy Sing, miner's helper	Killed.
22	Explosion at No. 4 mine, Comox, Feb. 8	Jew Hung Kit, miner's helper	Killed.
23	Explosion at No. 4 mine, Comox, Feb. 8	Wo Wee How, miner's helper	Killed.
24	Explosion at No. 4 mine, Comox, Feb. 8	Jung Wah, miner's helper	Killed.
25	Explosion at No. 4 mine, Comox, Feb. 8	Fong Dong, miner's helper	Killed.
26	Explosion at No. 4 mine, Comox, Feb. 8	Wong Toy Sing, miner	Killed.
27	Explosion at No. 4 mine, Comox, Feb. 8	Jung Hah, miner	Killed.
28	Explosion at No. 4 mine, Comox, Feb. 8	Jung Tow, miner	Killed.
29	Explosion at No. 4 mine, Comox, Feb. 8	Sick Quee, miner	Killed.
30	Explosion at No. 4 mine, Comox, Feb. 8	Jung Ding, miner	Killed.
31	Explosion at No. 4 mine, Comox, Feb. 8	Jung Kept, miner's helper	Killed.
32	Explosion at No. 4 mine, Comox, Feb. 8	Louise Long, miner	Killed.
33	Explosion at No. 4 mine, Comox, Feb. 8	Choy Duck, miner's helper	Killed.
34	Explosion at No. 4 mine, Comox, Feb. 8	Jung Woy, miner's helper	Killed.
35	Explosion at No. 4 mine, Comox, Feb. 8	Hing Jung, miner's helper	Killed.
36	Explosion at No. 4 mine, Comox, Feb. 8	Jung Dong, driver	Killed.
37	Explosion at No. 4 mine, Comox, Feb. 8	Jung Bing Poy, miner's helper	Killed.
38	Explosion at No. 4 mine, Comox, Feb. 8	Lee Goon, miner's helper	Killed.
39	Explosion at No. 4 mine, Comox, Feb. 8	Jung Gar Kay, miner	Killed.
40	Explosion at No. 4 mine, Comox, Feb. 8	J. Turner, labourer	Killed.
41	Explosion at No. 4 mine, Comox, Feb. 8	R. Smith, miner	Killed.
42	Explosion at No. 4 mine, Comox, Feb. 8	G. Martinello, tracklayer	Killed.
43	Explosion at No. 4 mine, Comox, Feb. 8	J. Freloni, hoist-boy	Killed.
44	Explosion at No. 4 mine, Comox, Feb. 8	W. Mitchell, hoist-boy	Killed.
45	Explosion at No. 4 mine, Comox, Feb. 8	Wm. Whitehouse, fireboss	Killed.
46	Explosion at No. 4 mine, Comox, Feb. 8	T. Williams, miner	Killed.
47	Explosion at No. 4 mine, Comox, Feb. 8	Norman Huby, shiftboss	Killed.
48	Explosion at No. 4 mine, Comox, Feb. 8	V. Cavallero, miner	Killed.
49	Explosion at No. 4 mine, Comox, Feb. 8	D. Sommerville, rope-rider	Killed.
50	Explosion at No. 4 mine, Comox, Feb. 8	A. Bonora, miner	Killed.
51	Explosion at No. 4 mine, Comox, Feb. 8	A. Charleston, miner	Killed.
52	Explosion at No. 4 mine, Comox, Feb. 8	Alexander Robertson, miner	Killed.
53	Explosion at No. 4 mine, Comox, Feb. 8	P. Manincora, miner	Killed.
54	Explosion at No. 4 mine, Comox, Feb. 8	Lai Cow, driver	Slight poisoning by gas.

COAST COLLIERIES—*Continued.*

No.	Name of Colliery and Date.	Name and Occupation.	Details.
55	Explosion at No. 4 mine, Comox, Feb. 8	Jung Wing, miner's helper	Slight poisoning by gas.
56	Explosion at No. 4 mine, Comox, Feb. 8	Jung Lun, miner's helper	Slight poisoning by gas.
57	Explosion at No. 4 mine, Comox, Feb. 8	Jung Wee, miner's helper	Slight poisoning by gas.
58	Explosion at No. 4 mine, Comox, Feb. 8	Wong Fung Chew, miner's helper	Slight poisoning by gas.
59	Explosion at No. 4 mine, Comox, Feb. 8	R. T. Brown, miner	Slight poisoning by gas.
60	Explosion at No. 4 mine, Comox, Feb. 8	James Gibb, miner	Slight poisoning by gas.
61	Explosion at No. 4 mine, Comox, Feb. 8	J. Webber, rope-rider	Slight poisoning by gas.
62	Explosion at No. 4 mine, Comox, Feb. 8	Steve Danyluk, driver	Slight poisoning by gas.
63	No. 4 mine, Comox (C.C.), June 4	Chan Yock, miner	Killed by falling rock.
64	No. 4 mine, Comox (C.C.), July 20	Wong Chung, labourer	Fatally injured when struck by empty trip going down the slope.
65	No. 4 mine, Comox (C.C.), Aug. 20	Mah Lung, slopeman	Fatally injured when struck by trip.
66	No. 4 mine, Comox (C.C.), Sept. 10	How Mow, miner	Fatally injured by falling rock.
67	Extension No. 1 (C.C.), June 26	Henry Pollard, miner	Simple fracture of ninth and tenth ribs on left side, caused by falling rock.
68	No. 6 mine (C.C.), Dec. 14	George Orr, miner	Left tibia broken in two places when centre rock fell from face.
69	No. 3 mine (C.C.), Sept. 17	A. Romano, miner	Third finger on right hand badly crushed when jammed between rail and bumper of car.
70	No. 3 mine (C.C.), Dec. 28	J. McKendrick, miner	Radius of left arm fractured when falling over some timber.
71	No. 5 mine, S.W. (C.C.), April 18	Jas. Craig, hoistman	Simple fracture of left forearm, caused when horse jerked car off track, causing him to fall on his hand on rail.
72	No. 5 mine, S.W. (C.C.), July 30	William Wallace, miner	Small bone broken in left leg near ankle and lacerated face, caused when rock fell, breaking board upon which he was standing, causing him to fall to the floor.
73	Granby No. 1 (G.C.M.S. & P. Co.), May 10	John James, miner	Fracture of right leg below knee, caused when caught by rope attached to loaded trip.
74	Granby No. 1 (G.C.M.S. & P. Co.), May 12	Alphonse Clark, switcher	Fractured right thigh, fractured base of skull, and injuries to the chest when struck by empty trip. Fatal.
75	Granby No. 1 (G.C.M.S. & P. Co.), June 25	John Round, rope-rider	Compound fracture right upper arm and right leg, large scalp wound, several abrasions on back and left ribs, caused when tram came uncoupled and ran back, catching his clothing and pulling him under loaded tram.
76	Granby No. 1 (G.C.M.S. & P. Co.), Nov. 26	Sydney Tickle, apprentice machinist	Burning and laceration of cornea; also surface burns on face and neck; was pouring melted babbitt in bearing when metal blew into his face.

NICOLA-PRINCETON COLLIERIES.

REPORTED BY JOHN G. BIGGS, INSPECTOR.

No.	Name of Colliery and Date.	Name and Occupation.	Details.
77	No. 3 mine (Coalmont Collieries), Feb. 23	E. Hayes, miner	Right leg broken below the knee by falling timber.
78	No. 3 mine (Coalmont Collieries), Nov. 14	Peter Mlostek, miner	Right leg badly bruised, caused when brace gave way, allowing cap to fall.
79	No. 3 mine (Coalmont Collieries), Nov. 19	Tom Buckowe, miner	Right side bruised when caught by car coming down slope.
80	No. 3 mine (Coalmont Collieries), Dec. 10	John H. McClellen, rope-rider	Badly cut on top of head when thrown from car against stringer.
81	No. 3 mine (Coalmont Collieries), Dec. 14	Oscar Vick, driver	Top right index finger cut off when caught between the hook at end of chain and the rail.
82	No. 3 mine (Coalmont Collieries), Dec. 21	Robert Boyd, miuer	Right forearm cut and buised, right ankle badly swollen, small scalp-wound, caused by fall of coal.
83	No. 7 mine (Coalmont Collieries), Aug. 18	Fred Gilderdale, miner	Compound fracture of left leg, caused when rock fell, jamming his leg against post.

EAST KOOTENAY DISTRICT.

REPORTED BY J. MACDONALD AND R. STRACHAN, INSPECTORS.

84	Coal Creek No. 3 (C.N.P.C.C.), Jan. 18	Toniguzzi Louis, brusher's helper	Complicated fracture of ribs on left side with internal hæmorrhage, bruised arm and lacerated face, caused by fall of coal.
85	Coal Creek No. 2 (C.N.P.C.C.), Aug. 7	James Davidson, miner	Dislocation and compound fracture right elbow and forearm and sprained right ankle, caused by a fall of rock.
86	Coal Creek No. 2 (C.N.P.C.C.), Oct. 24	Alex Thornton, switch-boy and flagger	Simple fracture of right arm at the wrist, caused when slipping and falling on his right hand.
87	C.C. No. 1 North (C.N.P.C.C.), Sept. 26	E. Gibson, miner	Left ankle fractured, caused by falling rock.
88	C.C. No. 1 South (C.N.P.C.C.), Feb. 6	Giegnm Joe, timberman's helper	Fractured femur, bruised head, chest, and arm.
89	C.C. No. 1 East (C.N.P.C.C.), Jan. 29	Thos. Ross, driver	Simple fracture of left forearm, caused by catching elbow on centre post and car.
90	C.C. No. 1 East (C.N.P.C.C.), April 24	W. E. Laurence, miner	Fracture of right leg above ankle, caused by falling rock.
91	C.C. No. 1 East (C.N.P.C.C.), Dec. 6	Alexander Branch, gripper	Left great toe lacerated and fractured when caught in split rail and forced through by rope.
92	Michel No. 8 (C.N.P.C.C.), Jan. 11	M. Borsato, miner	Leg fractured by piece of falliug rock.
93	Michel No. 8 (C.N.P.C.C.), June 13	Thos. Wright, miner	Lacerated leg, caused when struck by some fine coal after firing shot.
94	Michel No. 3 (C.N.P.C.C.), Feb. 1	J. Whittaker, miner	Fractured left leg and bruised shoulder, caused by falling coal.
95	Michel No. 3 (C.N.P.C.C.), Mar. 13	A. Klemuk, miner	Fractured left fibula, caused by fall of coal.

EAST KOOTENAY DISTRICT—*Continued.*

96	Michel No. 3 (C.N.P.C.C.), June 16	A. Keeling, miner	Compound fracture right leg through slipping and having leg caught in rope.
97	Michel No. 3 (C.N.P.C.C.), Nov. 19	John Marriette, miner	Fractured back, caused by fall of coal.
98	Michel No. 3 (C.N.P.C.C.), Nov. 29	V. D'Agnola, miner	Left leg fractured when struck by rebounding timber.
99	No. 4 mine (Corbin Coal Co.), Jan. 25	Basil Littley, hoistman and switchman	Simple fracture of fibula of right leg, caused by failing to sprag cars behind.

PROSECUTIONS UNDER "COAL-MINES REGULATION ACT."

Mine and Date.	Name and Occupation.	Offence charged.	Judgment.
Nanoose, Mar. 5	Louis Hadevis, miner	Smoking pipe in mine	Fled the country; warrant out for arrest; miner's cert. suspended for two years.
No. 4, Comox, Mar. 8	Wung On, loader	Had safety-lamp key in his possession in mine	30 days' imprisonment.
No. 4, Comox, Mar. 8	Mike Boladovitch, miner	Took unexamined safety-lamp into mine	Fined $10 and costs; miner's cert. suspended for 18 months.
Middlesboro, Mar. 19	John Slater, labourer	Had pipe in mine	Fined $5 and costs.
Granby No. 1, Cassidy, Mar. 26	Joseph Mayovsky, miner	Had pipe in mine	Fined $10 and costs.
No. 4, Comox, Mar. 26	Thos. Cunliffe, shiftboss	Fired shots without making examination of place for gas	Fined $10 and costs; second- and third-class certs. of competency suspended for 18 mos.
Coalmont, April 4	John Gilliford, loader	Matches in mine	Fined $5 and costs.
Coalmont, April 4	Louis Canich, miner	Matches in mine	Fined $5 and costs.
Coalmont, April 4	John Millar, miner	Tobacco in mine	Fined $5 and costs.
Granby No. 1, Cassidy, April 7	Henry Clark, switcher	Breach of special rules	Fined $10 and costs.
Granby No. 1, Cassidy, April 7	Chas. Bell, driver-boss	Breach of special rules	Fined $10 and costs.
Granby No. 1, Cassidy, April 7	Jas. Milligan, rope-rider	Breach of special rules	Fined $10 and costs.
No. 4, Comox, April 9	Lim Kee Sing, miner's helper	Matches in mine	3 months' imprisonment.
No. 4, Comox, April 10	Hichirze Shirizama, miner	Matches in mine	3 months' imprisonment.
No. 5, Comox, April 10	K. Hishi, miner	Matches in mine	Fled the country.
No. 4, Comox, May 10	Robert Walker, fireboss	Violation of General Rule No. 8, C.M.R.A.	Case dismissed.
No. 4, Comox, May 10	Robert Barker, fireboss	Violation of General Rule No. 8, C.M.R.A.	Accused left the country.
No. 4, Comox, May 10	Robert Barker, fireboss	Violation of General Rule 12, C.M.R.A.	Accused left the country.
No. 3, Extension, June 11	Michael Zizac, labourer	Violation of Special Rule 173, going beyond danger board and fence	Fined $10 and costs.
Granby No. 1, Cassidy, Aug. 1	John Nigro, miner	Violation of General Rule No. 12, sec. 91, C.M.R.A. (unlawfully firing shots)	Fined $10 and costs; miner's cert. suspended for 12 months.
No. 1, Nanaimo, Dec. 21	Joseph Sutton, miner	Violation of Special Rule 126 (not timbering place)	Fined $10 and costs.
No. 1, Nanaimo, Dec. 21	John Hamilton, fireboss	Violation of Special Rule No. 39 (failing to carry out duties)	Fined $10 and costs.

METALLIFEROUS MINES SHIPPING IN 1923

NORTH-WESTERN DISTRICT (No. 1).

ATLIN MINING DIVISION

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Cherokee	Atlin	J. M. Ruffner	Atlin	Silver lead

SKEENA MINING DIVISION

Belmont-Surf Inlet	Surf inlet	Belmont-Surf Inlet Mines, Ltd.	Surf Inlet	Gold, silver, copper

NASS RIVER MINING DIVISION

Esperanza	Kitsault river	R. Armour, Sec.	Anyox	Silver, gold
Hidden creek	Anyox	Granby Cons. M. S. & P. Co.	Anyox	Copper, silver, gold
United Metals	Illiance river	T. H. Pidduck	202 Lumber Exchg. Bldg., Seattle	Silver, lead

PORTLAND CANAL MINING DIVISION

Premier	Salmon river	Premier Gold Mining Co., Ltd.	Premier	Gold, silver

NORTH-EASTERN DISTRICT (No. 2).

OMINECA MINING DIVISION

Henderson	Hudson Bay mountain	Duthie Mines, Ltd.	Smithers	Silver, lead

CENTRAL DISTRICT (No. 3).

YALE, ASHCROFT, AND KAMLOOPS MINING DIVISIONS

Iron Mask	Kamloops	Kamloops Copper Co.	Kamloops	Gold, silver

NICOLA AND VERNON MINING DIVISIONS

Octagon		Octagan Mining Co.	F. H. Jewell, Oakland, Cal.	Silver, gold

SOUTHERN DISTRICT (No. 4).

GREENWOOD MINING DIVISION

Bell	Wallace mountain	J. N. Paton	Greenwood	Silver, gold
Bounty Fraction	Wallace mountain	John McKellar	Beaverdell	Silver
Combination	Greenwood	Eholt Mining Co.	110 Hyde Building, Spokane	Silver
Crescent	Greenwood	Wm. A. Thompson	Midway	Silver
Lightning Peak	Lightning Peak	W. Williams	Edgewood	Silver
Nodaway	Wallace mountain	Jas. Cunningham	Beaverdell	Silver
Preston	Greenwood	E. A. Wanke	Greenwood	Silver
Providence	Greenwood		Providence	Silver, lead
Revenge	Beaverdell	Revenge Syndicate		Silver, lead
Sally	Beaverdell	Wallace Mt. Mines, Ltd.	Penticton	Silver

OSOYOOS AND SIMILKAMEEN MINING DIVISIONS

Nickel Plate	Hedley	Hedley Gold Mining Co.	Hedley	Gold, arsenic
Shipper	Similkameen	Fred Bowden	Similkameen	Silver

EASTERN DISTRICT (No. 5).

FORT STEELE MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Guindon	Moyie	F. Guindon	Moyie	Silver, lead, zinc.
Park	Marysville	J. F. Hutcheroft	Cranbrook	Silver, lead.
St. Eugene	Moyie	Consolidated M. & S. Co.	Trail	Silver, lead.
Sullivan	Kimberley	Consolidated M. & S. Co.	Trail	Lead, zinc, silver.

GOLDEN AND WINDERMERE MINING DIVISIONS.

Isaac	Brisco	J. J. Coughlan, Jr.	Vancouver	Lead, silver.
Nip & Tuck	Toby creek	W. D. McMillan	Windermere	Silver, lead.
Paradise	Toby creek	R. R. Bruce	Invermere	Silver, lead.
Steele	Brisco	A. J. Hughes	Brisco	Silver, lead.

AINSWORTH MINING DIVISION.

Caledonia	Blaylock	A. S. McCready	Silverton	Silver, lead.
Cork	Ainsworth	Cork-Province Mines, Ltd.	Kaslo	Lead, silver, zinc.
Florence	Ainsworth	Florence Silver Mining Co.	517 Hutton Building, Spokane	Lead, silver.
Howser	Glacier creek	Howser Mining Co.	Howser	Silver, lead.
Krao	Ainsworth	Krao Silver Lead Mining Co.	Kaslo	Silver, lead.
Liberty	Keen creek	Wm. Y. Williams	Spokane	Lead, silver.
Maestro	Ainsworth	H. Giegerich	Kaslo	Lead, silver.
Sailor Boy	Crawford creek	G. Foulkes	Rossland	Lead, silver.
Silver Bear	South fork	M. S. Davys	Kaslo	Silver, lead.
Silver Hoard	Ainsworth	H. Giegerich	Kaslo	Silver, lead.
Tariff	Ainsworth	Tariff Mining Co	Box 522, Nelson	Lead, silver.
Whitewater	Retallack	Whitewater Mines, Ltd.	Kaslo	Silver, zinc, lead.

SLOCAN MINING DIVISION.

American Boy	Sandon	John Vallance	Box 171, Sandon	Silver, lead, zinc.
Black Colt	Sandon	George Petty	Sandon	Silver, zinc, lead.
Bosun	New Denver	Rosebery-Surprise Mining Co.	New Denver	Silver, lead, zinc.
Canadian	Sandon	J. M. Brandon	Sandon	Silver, lead.
Galena Farm	Silverton	R. F. Ainslie	Silverton	Silver, lead, zinc.
Gem	Sandon	M. J. Byrne	Sandon	Lead, silver.
Hewitt	Silverton	M. S. Davys	Box 397, Kaslo	Silver, lead.
Metallic	Silverton	A. S. McCready	Silverton	Silver, lead.
Mollie Hughes	New Denver	Molly Hughes Syndicate	New Denver	Silver, gold, lead.
Monitor	Sandon	Rosebery-Surprise Mining Co.	Sandon	Silver, lead, zinc.
Mountain Chief	New Denver	Frank Edwards	New Denver	Silver, lead, zinc.
Rambler	New Denver	W. A. Cameron	New Denver	Silver, lead.
Ruth	Sandon	J. B. Sunderland	Vancouver	Silver, lead.
Silversmith	Sandon	J. B. White	Spokane	Silver, lead, zinc.
Sovereign	Sandon	C. Cunningham	Sandon	Silver, lead.
Standard	Silverton	W. H. North	Silverton	Silver, zinc, lead.
Surprise	Sandon	Rosebery-Surprise Mining Co	Sandon	Silver, lead, zinc.
Van Roi	Silverton	C. Cunningham	Silverton	Silver, lead, gold.
Victor	Sandon	Geo. Petty	Sandon	Silver, lead, gold.
Lone Bachelor	Sandon	Geo. Petty	Sandon	Silver, lead, zinc.
Soho	Three Forks	J. C. Ryan	Sandon	Silver, lead.
Elkhorn	Alamo	G. T. Gormley	Sandon	Silver, lead.
Noonday	Sandon	O. V. White	Sandon	Silver, lead.

SLOCAN CITY MINING DIVISION.

Anna	Springer creek	K. E. Zimmerman	Slocan	Silver.
L. T	Springer creek	D. B. O'Neail	Slocan	Silver, lead.
Meteor	Slocan	W. A. Buchanan	Slocan	Silver, gold.
Ottawa	Slocan	E. Graham	Slocan	Silver.
Peg Leg	New Denver	E. Shannon	New Denver	Silver, lead, zinc.
Slocan Chief	Enterprise	Pat Maguire	Slocan	Silver, lead.

NELSON AND ARROW LAKE MINING DIVISIONS.

Emerald	Sheep creek	W. J. Turner	Salmo	Silver, lead.
Granite	Granite	D. H. Norcross	Box 296, Nelson	Gold, silver, copper.
Kootenay Belle	Salmo	Arthur Lakes	Salmo	Gold, silver.
Molly Gibson	Kokanee creek	W. A. Cameron	New Denver	Silver, lead.

TRAIL CREEK, TROUT LAKE, REVELSTOKE, AND LARDEAU MINING DIVISIONS

Mine or Group.	Locality.	Owner or Agent.	Address	Character of Ore
Golden Drip	Rossland	M. E. Purcell	Rossland	Gold silver lead
L.X.L.	Rossland	R. B. Shellady	Rossland	Gold silver
Le Roi, etc	Rossland	Consolidated M. & S. Co.	Rossland	Gold copper silver

WESTERN DISTRICT (No. 6)

VANCOUVER AND SMALLER ISLANDS; VANCOUVER AND NEW WESTMINSTER DIVISIONS

Britannia	Britannia Beach	C. P. Browning	Britannia Beach	Copper gold silver
Tidewater	Sidney inlet	C. J. Abrams	Sidney Inlet	Copper silver gold

LIST OF CROWN GRANTED MINERAL CLAIMS.

CROWN GRANTS ISSUED IN 1923.

CASSIAR.

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Jack Pine	Atlin	John Dunham	4360	38.50	Oct. 26
Bonanza Fraction	Nass River	Joshua Debell Meenach, Ralph Dexter Brown, John Holmgren, and Charles Z. Frey	4070	42.62	April 26
Silver Dream	"	William Frederick Eve	4258	47.33	Mar. 20
Silver Horde	"	Arne, Davedson, Allan F. Miner, and Donald W. Cameron	3804	46.30	Jan. 15
Silver Horde No. 2	"	" " "	3805	49.60	Jan. 15
Silver Horde No. 3	"	Allan F. Miner and Donald W. Cameron	3802	41.40	Jan. 15
Silver Horde Fraction	"	" "	3803	13.60	Jan. 15
Uist	"	Angus McLeod, and Donald J. MacVicar	4337	50.50	Oct. 26
Huckleberry	Omineca	Horace Cooper Wrinch	4272	48.37	Sept. 25
Independence Fraction	"	Alfred Shaw	4275	11.19	Oct. 10
I. X. L.	"	Horace Cooper Wrinch	6551	51.01	May 10
Mandon	"	"	4273	51.65	Aug. 11
Silver King	"	"	6547	51.65	May 10
Silver Queen	"	"	6549	51.18	May 10
Silver Tip	"	"	6550	49.76	May 10
Tyee	"	"	6548	50.51	May 10
Algonquin	Portland Canal	Herbert James Mansfield	1490	39.22	July 7
Border	"	Charles Henry Lake	4165	23.83	Mar. 1
Cobalt No. 2	"	James Benjamin Sunderland	4054	23.56	May 3
Cobalt	"	" "	4053	23.71	April 30
International	"	Premier Gold Mining Co., Ltd.	3930	50.15	May 3
Jean	"	Dalby Brooks Morkill	4196	46.80	Nov. 6
Lucky Fraction	"	Anna M. Paul	4281	10.10	Mar. 1
Mineral Zone	"	Outland Silver Bar Mines, Ltd. (N.P.L.)	4189	14.57	Feb. 16
Morn	"	John Hovland	4064	43.30	Dec. 7
Mountain Girl	"	Outland Silver Bar Mines, Ltd. (N.P.L.)	4190	32.81	Feb. 16
Premier Fraction	"	Premier Gold Mining Co., Ltd	4279	0.96	May 3
Shure	"	William McGrew and Charles Knipple	4041	48.81	July 6
Sure Money	"	" "	4017	51.65	July 6
Sure Money No. 1	"	" "	4018	51.42	July 6
Wood Fraction	"	Premier Gold Mining Co., Ltd.	3931	16.90	May 3
Trites	"	" "	3611	30.10	May 3
Winner	"	James Benjamin Sunderland	4116	15.34	April 30
General Joffre	Skeena	George Bath, Michael McFadden, Neil McTavish, John Alexander McLeod, Gordon C. Denison, Ford Robertson, Alfred E. Wright, and Alfred C. Garde	6505	44.65	July 6
Irish Rose	"	George Bath, Michael McFadden, Neil McTavish, John Alexander McLeod, Gordon C. Denison, Ford Robertson, Alfred E. Wright, and Alfred C. Garde	6504	43.37	July 6
Lord Kitchener	"	George Bath, Michael McFadden, Neil McTavish, John Alexander McLeod, Gordon C. Denison, Ford Robertson, Alfred E. Wright, and Alfred C. Garde	6503	50.07	July 6
Verda	"	George Bath, Michael McFadden, Neil McTavish, John Alexander McLeod, Gordon C. Denison, Ford Robertson, Alfred E. Wright, and Alfred C. Garde	6507	49.09	July 6
Young Bull	"	George Bath, Michael McFadden, Neil McTavish, John Alexander McLeod, Gordon C. Denison, Ford Robertson, Alfred E. Wright, and Alfred C. Garde	6502	51.65	July 6
Derby	Queen Charlotte	Charles Joe Benson	2337	43.60	Feb. 16
Epsom	"	"	2336	39.50	Feb. 16
Garfield	"	Alex. Rogers	2338	34.60	Feb. 16
Iron Duke	"	Charles Joe Benson	2331	33.16	Feb. 16
Iron Duke No. 1	"	Alex. Rogers	2332	49.08	Feb. 16
Iron Duke No. 2	"	Charles Joe Benson	2333	29.50	Feb. 16
Iron Duke No. 3	"	Alex. Rogers	2334	13.09	Feb. 16
Mineral Spring	"	Duncan Fraser	2339	26.20	Feb. 16
Simcoe Fraction	"	Alex. Rogers	2335	11.55	Feb. 16

EAST KOOTENAY.

Ace	Fort Steele	The Consolidated Mining and Smelting Co. of Canada, Ltd.	13192	51.65	Dec. 11
Ack Ack	"	" " " "	13190	51.65	Dec. 12
Acme	"	" " " "	13186	51.65	Oct. 2
Another Fraction	"	" " " "	6726	2.36	Sept. 18
Apex	"	" " " "	13185	51.65	Sept. 18
Base	"	" " " "	10233	51.65	Dec. 13
Batman	"	" " " "	13163	51.65	Oct. 4
Blighty	"	" " " "	10237	51.65	Dec. 13
Blimp	"	" " " "	13195	43.73	Dec. 11
Bon	"	" " " "	10988	50.84	Dec. 12
Boom	"	" " " "	10231	51.65	Dec. 13
Brass Hat	"	" " " "	10235	51.65	Dec. 13

EAST KOOTENAY—*Continued*

Claim.	Division.	Grantee	Lot	Acres	Date
Bus	Fort Steele..	The Consolidated Mining and Smelting Co. of Canada Ltd.			
Captain	"	"			
Castor Fraction	"	"			
Cayuse Fraction	"	"			
Corporal	"	"			
Doure	"	"			
Dud	"	"			
Perian Fraction	"	"			
Gold Dust	"	"			
Hutax	"	"			
Jam	"	"			
Lancejack	"	"			
Lieut	"	"			
Lorry Fraction	"	"			
M. O. Fraction	"	"			
Observer Fraction	"	"			
Oil	"	"			
One Fraction	"	"			
Onion	"	"			
Orchard	"	"			
Parachute	"	"			
Park	"	"			
Pebeco	"	"			
Petit	"	"			
Pilot	"	"			
Pop	"	"			
Rasp	"	"			
Red Tape	"	"			
Ritz Fraction	"	"			
San Fraction	"	"			
Sergeant	"	"			
Silver Glance	"	John W. Emerson			
Sine	"	The Consolidated Mining and Smelting Co. of Canada, Ltd.			
Snap	"	"			
Spud	"	"			
Staff	"	"			
Straw	"	"			
Taniac	"	"			
Tar Fraction	"	"			
Too Much	"	"			
V.A.D. Fraction	"	"			
W.A.A.C.	"	"			
Wren	"	"			
Yap	"	"			
Zenith	"	"			
St. Etienne Fraction	Golden	Erskine Jones			
Hot Punch No. 2	Windermere	John Edgar Stoddart, John Edgar Stoddart and Arthur Murray Chisholm, executors of the estate of Willis Ben Abel, deceased			
Hot Punch No. 3	"	John Edgar Stoddart, John Edgar Stoddart and Arthur Murray Chisholm, executors of the estate of Willis Ben Abel, deceased			
Hot Punch No. 4	"	Edward Parry			
Mountain Lion	"	Ella Stoddart			
Star No. 2	"	John Edgar Stoddart.			

WEST KOOTENAY

Baldwin	Ainsworth	Henry Giegerich			
Bourbon	"	"			
Bourbon No. 2	"	"			
Bourbon Fraction	"	"			
Bowster	"	"			
Bunker Hill	"	Charles Lind			
King	"	Henry Giegerich			
Last Chance	"	Matilda Clara Augustine			
Magnolia	"	John Morrison Brown, James Madison Miller and Hugh Rankin Brown			
Nelson	"	John Morrison Brown, James Madison Miller and Hugh Rankin Brown			
Queen	"	Henry Giegerich			
Superior	"	John Morrison Brown, James Madison Miller and Hugh Rankin Brown			
Treasure	"	Charles Lind			
Arizona	Nelson	David Edward Doyle			
Aberdeen	Aberdeen	John W. Emerson			

BOUNDARY

Oregon Fraction	Grand Forks	Napoleon Peter Chanon			
Yorkshire Lass	Greenwood	David G. Smith			
Lemon No. 10	Similkameen	Allenby Copper Co., Ltd. (S.P.L.)			
Lowell No. 2	"	"			
Olivene No. 3	"	"			

BOUNDARY—*Continued.*

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Passayton	Similkameen	John Crowley	229	51.65	Oct. 26
Pearce No. 3	"	Allenby Copper Co., Ltd. (N.P.L.)	2579s	48.66	July 31
Pen Mar	"	" "	2293s	42 00	July 31
Periscope Fraction	"	" "	2307s	24.10	July 31
St. Louis Fraction	"	" "	2308s	45.58	July 31
Seattle	"	" "	2305s	51.60	July 31
Side Hill Fraction	"	" "	2577s	51.63	July 31
Silver No. 1 Fraction	"	" "	2576s	26.23	July 31
Snoqualmie	"	" "	2294s	51.65	July 31
Summit Fraction	"	" "	2297s	22.10	July 31
Tacoma	"	" "	2306s	46.79	July 31
Columbia	Lillooet	Harvey Anson Christie	1122	51.65	Mar. 14
Golden Stripe	"	"	1124	51.65	Mar. 14
Mascot	"	"	1125	46.32	Mar. 14
Shamrock	"	"	1123	51.65	Mar. 14
Gypsite	Clinton	International Gypsum Corporation	2323	40.44	Oct. 26
Gypsite No. 2	"	" "	2324	46.85	Oct. 30
Province	"	Warren A. Davidson, Daniel Hurley, Geo. Edward Prosser, and Frederick Blackman Holmes	2649	41.65	Feb. 12
Basque No. 1	Ashcroft	Basque Chemical Production Co., Ltd.	1067A	24.53	Sept. 13
Basque No. 2	"	" "	1070A	20.70	Sept. 13
Basque No. 3	"	" "	1072A	51.65	Sept. 13
Basque No. 4	"	" "	1073A	13.72	Sept. 13
Basque Fraction	"	" "	1074A	22.61	Sept. 13
Cindar	"	Rose Burr, John Wood, and John Freemont Smith, administrators of the estate of Archibald Deeker, deceased.	4575	51.65	April 6
Epsom	"	Basque Chemical Production Co., Ltd.	1069A	51.65	Sept. 13
Epsom Fraction	"	" "	1068A	33.40	Sept. 13
Forge	"	Rose Burr, John Wood, and John Freemont Smith, administrators of the estate of Archibald Deeker, deceased.	4574	51.65	April 6
Glossie	"	Rose Burr, John Wood, and John Freemont Smith, administrators of the estate of Archibald Deeker, deceased.	4576	49.60	April 6
Salt Fraction	"	Basque Chemical Production Co., Ltd.	1071A	46.66	Sept. 16
Madge	Yale	Stephen Gisby and Sidney Gisby	1079	51.04	Aug. 11
Salmon River Fraction	"	" "	1104	26.94	Aug. 11

VANCOUVER ISLAND AND COAST.

Betty	Nanaimo	William Thomas Hoyes	1341	19.21	Mar. 26
Bessie B	"	John D. Breeze	1667	46.17	April 16
Blue Grouse	"	William T. Hoyes	1663	20.12	July 19
Blue Jay	"	James Cross	1664	22.70	May 9
Couger	"	"	1661	26.90	Mar. 26
East Paw	"	Paramount Mining Co., Ltd	1671	51.53	July 17
Elwood	"	William Thomas Hoyes	1342	16.28	Sept. 5
Grey Squirrel	"	James Cross	1666	27.09	Mar. 26
Juneau	"	Otto Kurtzhals	69	45.97	Oct. 15
Kim	"	Mabel Kurtzhals	72	35.29	Oct. 15
Lynx	"	James Cross	1660	28.76	Mar. 26
Mink	"	John Latimer Kerr	1659	38.40	April 16
Morore	"	Rudolf Kurtzhals	71	51.65	Oct. 15
North Paw	"	The Paramount Mining Co., Ltd	1670	32.00	Mar. 26
Ohur	"	Joseph Purviance	70	51.65	Oct. 2
Otter	"	John D. Breeze	1612	31.00	Sept. 5
Pearl	"	Lilian E. Jackson	1340	32.30	July 17
Red Deer	"	John D. Breeze	1343	47.25	Sept. 5
Red Squirrel	"	John Latimer Kerr	1665	28.51	April 19
South Paw	"	The Paramount Mining Co., Ltd	1668	43.65	Mar. 26
Texada	"	Rosana Cathrine Payne	243	51.41	Jan. 18
West Paw	"	Paramount Mining Co., Ltd	1669	50.45	July 17
Black Bird Fraction	Quatsino	Jane Halliday	1545	2.41	Oct. 15
Side Hill Fraction	"	William May Halliday	1543	29.58	Oct. 15
Snow Line Fraction	"	Jane Cook	1544	6.70	Oct. 15
Bell	Alberni	Sydney Seymour Saunders	1366	35.95	April 9
Gloria	"	Horace Edward Newton	2586	51.65	Sept. 5
Black Bear	New Westm'ster	Edwin R. Fitzgerald, Charles Henry Ziegler, Matthew John Barr, and Jesse Gourlay Anderson	1178	36.84	Jan. 2
Blue Jay	"	Edwin R. Fitzgerald, Charles Henry Ziegler, Matthew John Barr, and Jesse Gourlay Anderson	1177	37.08	Jan. 2
Red Bug	"	Edwin R. Fitzgerald, Charles Henry Ziegler, Matthew John Barr, and Jesse Gourlay Anderson	1176	46.85	Jan. 2
Asquith	Vancouver	Britannia Mining and Smelting Co., Ltd.	4956	51.65	Sept. 25
Balfour	"	" "	4954	51.61	Sept. 25
Beatty	"	" "	4952	51.63	Sept. 25
Blue	"	Mabel Angus	5057	40.10	Mar. 14
Bristol	"	Britannia Mining and Smelting Co., Ltd.	4955	51.65	Sept. 25
Cardiff	"	" "	4960	51.61	Sept. 25
Dover	"	" "	4959	51.63	Sept. 25
Dublin	"	" "	4963	51.63	Sept. 25
Hull Fraction	"	" "	4957	48.37	Sept. 25
Leeds Fraction	"	" "	4958	42.09	Sept. 25
Naboh	"	William James Mogridge	4881	17.50	Mar. 14
Nish Fraction	"	Britannia Mining and Smelting Co., Ltd	4961	38.87	Sept. 25
Pearl	"	William James Mogridge	4990	40.01	Mar. 14
Redmond	"	Britannia Mining and Smelting Co., Ltd	4953	51.62	Sept. 25
Riga Fraction	"	" "	4861	47.09	Sept. 25
Ruby	"	Mabel Angus	5050	50.20	Mar. 14
Verdun	"	Britannia Mining and Smelting Co., Ltd	4962	51.63	Sept. 25

DEPARTMENT OF MINES

VICTORIA, B.C.

HON. WM. SLOAN, *Minister of Mines.*

R. F. TOLMIE, *Deputy Minister.*

WM. FLEET ROBERTSON, *Provincial Mineralogist and Assayer.*

D. E. WHITTAKER, *Provincial Analyst and Assistant Assayer.*

GEO. WILKINSON, *Chief Inspector of Mines.*

HENRY DEVLIN, *District Inspector*, Nanaimo.

T. R. JACKSON, *District Inspector*, Nanaimo.

ROBERT STRACHAN, *District Inspector*, Fernie.

JOHN MACDONALD, *District Inspector*, Fernie.

JOHN G. BIGGS, *District Inspector*, Merritt.

THOS. J. SHENTON, *Dist. Inspector*, Prince Rupert.

H. H. JOHNSTONE, *Temporary Inspector*, Nelson.

Resident Mining Engineers

GEO. A. CLOTHIER, No. 1 District, Prince Rupert.

J. D. GALLOWAY, No. 2 District, Hazelton.

A. W. DAVIS, No. 3 District, Kamloops.

P. B. FREELAND, No. 4 District, Grand Forks.

A. G. LANGLEY, No. 5 District, Revelstoke.

W. M. BREWER, No. 6 District, Nanaimo.

GOLD COMMISSIONERS AND MINING RECORDERS

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Atlin Mining Division	Atlin	C. L. Monroe	C. L. Monroe	Miss N. M. Mearns
Sub-office	Telegraph Creek			H. W. Dodd
"	Haines (U.S.)		(Com. for taking Affidavits)	Reuben M. Odell
"	Juneau (U.S.)		Ditto	Harold E. Brown
Stikine Mining Division	Telegraph Creek	H. W. Dodd	H. W. Dodd	
Sub-office	Boundary	"	"	John Wynne
Liard Mining Division	Telegraph Creek	"	"	
Sub-office	Porter			Chas. H. Smith
"	McDame Creek			Mike Larsen
"	Fort St. John			F. W. Beatton
Skeena Mining Division	Prince Rupert	A. M. Davies (Acting)	A. M. Davies (Acting)	
Sub-office	Kitimat			G. L. Anderson
"	Swanson Bay			D. Clough
"	Copper City			L. C. Skinner
"	Terrace			L. H. Kelly
"	Rosswood			Mrs. C. Wallace
"	Stewart (Portland Canal)			J. P. Scarlett
Nass River	Anyox	A. M. Davies (Acting)	J. Conway	
Sub-office	Aiyansh	"		A. E. Pineau
"	Alice Arm			Mrs. L. Cunningham
Portland Canal M.D.	Stewart	A. M. Davies (Acting at Pr. Rupert)	J. P. Scarlett	
Bella Coola Mining Div.	Prince Rupert	A. M. Davies (Acting)	A. M. Davies (Acting)	
Sub-office	Bella Coola			Hermann Rose Odegaard
"	Bella Bella			Jesse A. Pearkes
"	Ocean Falls			Geo. H. Hill
Queen Charlotte Min'g D.	Queen Charlotte	T. W. Horne	John L. Barge	
Sub-office	Jedway			Isaac Thompson
"	Masset			C. W. Cochrane
"	Lockeport			William Morgan
Omineca Mining Division	Smithers	Stephen H. Hoskins	Jas. E. Kirby	
Sub-office	Fort Grahame			T. A. Pitts
"	Finlay Forks			A. T. Shorewood
"	Fort St. James			Geo. C. Murray
"	Manson Creek			W. D. Steele
"	Telkwa			T. J. Thorp
"	Fort George			Geo. M. Dunn

GOLD COMMISSIONERS AND MINING RECORDERS—*Continued.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Omineca M.D.—*Con.*				
Sub-office	Hudson Hope			F. F. Monteith.
"	Fort St. John			F. W. Beatton.
"	Copper City			L. G. Skinner.
"	Terrace			L. H. Kenny.
"	Fort Fraser			J. D. Moore.
"	Pacific			T. H. McCubbin.
"	Hazelton			Sperry Cline.
"	Burns Lake			L. Mulvaney.
"	Usk			Jas. L. Bethurum.
"	Tatla Landing			R. C. McCorkell.
Peace River Mining Div.	Fort St. John	S. H. Hoskins (at Hazelton)	F. W. Beatton	
Sub-office	Fort George			G. Milburn.
"	Finlay Forks			A. T. Sherwood.
"	Hudson Hope			F. F. Monteith.
"	Pouce Coupe			Fred. Fraser.
Cariboo Mining Division	Barkerville	H. Beech	H. Beech	Mrs. H. Beech.
Sub-office	Quesnel	"		E. C. Lunn.
"	Fort George	"		Geo. Milburn.
"	McBride	"		S. Service.
Quesnel Mining Division	Williams Lake	H. B. Campbell	R. M. McGusty	
Sub-office	Quesnel			E. C. Lunn.
"	Likely			A. B. Campbell.
"	Barkerville			H. Beech.
Clinton Mining Division	Clinton	R. J. A. Dorrell	R. J. A. Dorrell	
Sub-office	Taseko Camp			T. A. Brett.
"	Williams Lake			R. M. McGusty
Lillooet Mining Division	Lillooet	John Dunlop	John Dunlop	
Kamloops Mining Division	Kamloops	E. Fisher	L. S. Brown	L. J. Price.
Sub-office	Chu Chua			George Fennell.
"	Vavenby			Hyde Finley.
"	Albas			C. O. Sjouquist.
Ashcroft Mining Division	Ashcroft	E. Fisher (at Kam.)	W. C. Adams	Miss Ada E. Astell.
Sub-office	Lytton			W. Greenwood.
Nicola Mining Division	Merritt	E. Fisher (at Kam.)	W. H. Boothroyd	
Yale Mining Division	Yale	" "		
Sub-office	Hope	" "	D. A. Hazelton	Mrs. D. A. Hazelton.
Similkameen Mining Div.	Princeton	Hugh Hunter	Hugh Hunter	
Sub-office	Hedley			R. E. Baxter.
Vernon Mining Division	Vernon	L. Norris	M. S. Morrell	
Greenwood Mining Div.	Greenwood	P. H. McCurrach	P. H. McCurrach	
Sub-office	Vernon			M. S. Morrell.
"	Rock Creek			Owen Wheeler.
"	Beaverdell			E. F. Ketchum.
Grand Forks Min. Div.	Grand Forks	Chas. Mudge	Chas. Mudge	
Osoyoos Mining Division	Penticton	W. R. Dewdney	W. R. Dewdney	
Sub-office	Olalla			R. W. Northey.
"	Hedley			R. E. Baxter.
"	Fairview			J. R. Brown.
Golden Mining Division	Golden	G. E. Sanborn	G. E. Sanborn	H. C. Moore.
Windermere Mining Div.	Wilmer	" (at Golden)	E. M. Sandilands	
Fort Steele Mining Div.	Cranbrook	F. A. Small	F. A. Small	
Sub-office	Fernie			R. J. Stenson.
"	Yahk			W. A. Walker.
Ainsworth Mining Div.	Kaslo	Ronald Hewat	A. McQueen	A. W. Anderson.
Sub-office	Howser			W. Simpson.
"	Trout Lake			Roy V. Jacobson (Acting);
"	Poplar			Arthur G. Johnston.
Slocan Mining Division	New Denver	Ronald Hewat (at Kaslo)	Angus McInnes	
Sub-office	Sandon			W. J. Parham.
Slocan City Mining Div.	Slocan	Ronald Hewat	T. McNeish	

GOLD COMMISSIONERS AND MINING RECORDERS—*Continued.*

Mining Division.	Location of Office.	Gold Commissioner	Mining Recorder	Sub-Recorder
Trout Lake Mining Div.	Trout Lake	Ronald Hewat	Roy V. Jacobson	
Nelson Mining Division	Nelson	J. Cartmel	J. Cartmel (Actg.	
Sub-office	Creston			R. Lamont
"	Ymir			Wm. Clark
"	Sheep Creek			Geo. Lyons
"	Salmo			M. C. Donaldson
Arrow Lake Min. Division	Nakusp	J. Cartmel (at Nelson)	Walter Scott	
Sub-office	Vernon			M. S. Morrell
Revelstoke Mining Div.	Revelstoke	Wynfield Maxwell	C. J. Aman	Newton R. Brown
Lardeau Mining Division	Beaton	" (at Revelstoke)	Ernest Roberts	
Trail Creek Mining Div.	Rossland	W. H. Reid	W. H. Reid	
Nanaimo Mining Division	Nanaimo	L. A. Dodd	L. A. Dodd	
Sub-office	Ladysmith			J. A. Knight
"	Alert Bay			Ernest H. Robinson
"	Vananda			Leonard Raper
"	Quathiaski Cove			S. Marshall
"	Granite Bay			Henry Twelle
Alberni Mining Division	Alberni	A. G. Freeze	A. G. Freeze	
Clayoquot Mining Division	Clayoquot	" (at Alberni)	W. T. Dawley	
Quatsino Mining Division	Quatsino	"	Eli Evenson	
Victoria Mining Division	Victoria	R. J. Steenson	R. J. Steenson	
New Westminster Min. D.	New Westminster	F. C. Campbell	I. Wintemute	
Sub-office	Harrison Lake			L. A. Agassiz
"	Chilliwack			J. Pelly
Vancouver Mining Div.	Vancouver	John Mahony	A. P. Grant	

TABLE OF CONTENTS.

Subject.	Submitted by	Page
Mineral Production	Provincial Mineralogist	7
Statistical Tables	" "	7 to 16
Progress of Mining during Year	" "	17
Statistical Tables—Digest of	" "	20 to 29
Bureau of Mines—Work of Year	" "	30
Assay Office Report	Assistant Provincial Assayer	31
Examination for Assayers	" " "	31
List of Licensed Assayers	" " "	32
North-western Mineral District (No. 1)—Report of Resident Mining Engineer	Geo. A. Clothier	34 to 91
Cassiar District		92
Atlin Mining Division—Report on	Gold Commissioner	92
Stikine and Liard Mining Division	" "	92
Skeena District		93
Skeena and Bella Coola Mining Divisions—Report on	Gold Commissioner	93
Nass River Mining Division	Mining Recorder	93
Portland Canal Mining Division	" "	94
Queen Charlotte Mining Division—Report on	Gold Commissioner	94
North-eastern Mineral District (No. 2)—Report of Resident Mining Engineer	J. D. Galloway	96 to 146
Cariboo District		147
Cariboo Mining Division—Report on	Gold Commissioner	147
Omineca Mining Division—Report on	" "	147
Quesnel Mining Division—Report on	Mining Recorder	148
Central Mineral District (No. 3)—Report of Resident Mining Engineer	A. W. Davis	149 to 172
Lillooet District		173
Lillooet Mining Division—Report on	Gold Commissioner	173
Clinton Mining Division—Report on	" "	173
Yale District		174
Nicola Mining Division—Report on	Mining Recorder	174
Vernon Mining Division—Report on	Gold Commissioner	174
Yale Mining Division—Report on	Mining Recorder	174
Ashcroft Mining Division—Report on	" "	175
Kamloops Mining Division—Report on	Gold Commissioner	175
Southern Mineral District (No. 4)—Report of Resident Mining Engineer	F. R. Freeland	176 to 192
Boundary District		193
Greenwood Mining Division—Report on	Gold Commissioner	193
Grand Forks Mining Division—Report on	" "	193
Osoyoos Mining Division—Report on	Mining Recorder	193
Similkameen Mining Division	" "	193
Eastern Mineral District (No. 5)—Report of Resident Mining Engineer	A. G. Langley	194 to 252
North-east Kootenay District		256
Golden and Windermere Mining Divisions—Report on	Gold Commissioner	256
Windermere Mining Division	Mining Recorder	256
South-east Kootenay District		256
Fort Steele Mining Division—Report on	Gold Commissioner	256
North-west Kootenay District—Report on	" "	257
Revelstoke Mining Division—Report on	Mining Recorder	257
Lardeau Mining Division—Report on	" "	257
Slocan District		258
Ainsworth Mining Division—Report on	Gold Commissioner	258
Slocan Mining Division—Report on	Mining Recorder	258
Slocan City Mining Division—Report on	" "	258
Trout Lake Mining Division—Report on	" "	258
Nelson District		259
Nelson Mining Division—Report on	Acting Gold Commissioner	259
Arrow Lake Mining Division	Mining Recorder	259

TABLE OF CONTENTS—*Continued.*

Subject.	Submitted by.	Page.
Rossland District		239
Trail Creek Mining Division—Report on	Gold Commissioner	239
Western Mineral Ditrict (No. 6)—Report by Resident Mining Engineer	W. M. Brewer	240 to 275
Vancouver Island and Coast—		
Alberni Mining Division	Gold Commissioner	276
Clayoquot Mining Division	Mining Recorder	276
Quatsino Mining Division	,, ,,	276
Nanaimo District		277
Nanaimo Mining Division—Report on	Gold Commissioner	277
Victoria District		277
Victoria Mining Division—Report on	Gold Commissioner	277
Vancouver Mining Division—Report on	Mining Recorder	278
New Westminster Mining Division—Report on	,, ,,	278
Inspection of Mines—		
Report of Chief Inspector	George Wilkinson	279
List of Holders of Certificates of Competency in Mine-rescue Work		285
Examinations of Coal-mine Officials		286
Board of Examiners—Report of Secretary	James Dickson	286
Inspection of Metalliferous Mines		297
Northern Inspection District	Inspector of District	297
West Kootenay and Boundary Districts	Inspectors of Districts	300
Nicola-Princeton District	Inspector of District	304
Coast District	,, ,,	305
Accidents in Metalliferous Mines	Chief Inspector	306
Coal-mining in British Columbia	Provincial Mineralogist	308
Collieries producing	,, ,,	310
Collieries of the Coast Inspection District	,, ,,	310
Collieries of the East Kootenay Inspection District	,, ,,	310
Table showing Output and Distribution of Coal, all Collieries		311
Table showing Men employed, all Collieries		312
Inspection of Coal-mines		313
Vancouver Island and Coast Inspection Districts	Inspectors of Districts	314
Northern Inspection District	Inspector of District	343
Nicola-Princeton Inspection District	,, ,,	345
East Kootenay Inspection District	,, ,,	360
Detailed Statement of Accidents	Inspectors of Districts	377
Prosecutions under "Coal-mines Regulation Act"	,, ,,	382
Shipping Mines—List of Metalliferous	Provincial Mineralogist	383
Crown-granted Mineral Claims, 1923	,, ,,	386
Gold Commissioners and Mining Recorders—List of	,, ,,	389
Index	,, ,,	395
List of Illustrations	,, ,,	At end.
Library Catalogue Slips	,, ,,	At end.

INDEX.

A.

	Page.
Aberdeen	161
(Portland Canal)	69
Accidents in collieries	377
Accidents in metalliferous mines	303, 306, 307
Ackscorth (Greenwood)	184
Adair (Skeena)	49
Adams (Slocan)	223
Agnes (Nelson)	215
AINSWORTH MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Report of Resident Mining Engineer	207
Producing mines	214
Office statistics	258
Ajax (Kamloops)	150
Akolkolex river	232
Alaska Juneau Mining Co.	80
Alaska Premier, Alaska	87
ALBERNI MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Report of Resident Mining Engineer	241
Office statistics	276
Alexandra (Nanaimo)	254
Alexandria, coal	126
Algunican Development Co.	76
Alice (Nass River)	56
Alice arm	37, 49
Alice Arm-La Rose Mining Co., Ltd.	57
Alice L. (Grand Forks)	177
Section of workings	178
Alki creek	207
Allenby	191
Allenby Copper Co.	191
Almo (Portland Canal)	82
Alpha Mines Syndicate	195
Alta lake, limonite	268
Amazon (Grand Forks)	179
Amelia (Golden)	198
American Boy (Slocan)	224, 301
American Boy (Omineca)	107
American creek	35
American Mining and Milling Co., Ltd.	67, 81
American Smelting and Refining Co. *Premier* mine	79
Amesbury	46
Anaconda (Similkameen)	192
(Kamloops)	150
Andesite, building stone	170
Angushume lake	137
Anna (Slocan City)	229
Antler creek, drilling on	122
ARROW LAKE MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Report of Resident Mining Engineer	234
Arsenic, *Nickel Plate*	35
Yale Mining Division	165
ASHCROFT MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Report of Resident Mining Engineer	150
Office statistics	175
Asphaltum, Francois lake	116
Assay Office, statistics	31
Assayers' examinations	31
Assayers, list of	32
ATLIN MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Report of Inspector	297
Gold placer	300
Office statistics	302
Aurora (Yale), arsenic	165
Aurora (Fort Steele)	206
Australian creek, coal	128
Autumn No. 1	46
Aveling coal property	120, 344
Azure lake	165

B.

	Page.
Babine-Bonanza Mining and Milling Co.	111
Baldie mountain (Kamloops)	151
Baramba Mining Co.	268
Barkerville	121
Barriere lake	150
Barytes (Golden), *Giant*	196
(Kamloops)	170
Basque	171
Bauxite, Victoria Mining Division	268
Bayonne (Nelson)	219
Bayview (Portland Canal)	78
Bear (Skeena)	47
Bear river (Portland Canal)	70
Beaver (Skeena)	49
Bell (Vancouver)	287
Lost creek (Greenwood)	182
(Greenwood)	184, 301
BELLA COOLA MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Report of Resident Mining Engineer	44
BELLA COOLA MINING DIVISION—*Continued*	
Office statistics	93
Magnetite	45
Bellevue (Nass River)	61
Belmont Surf Inlet Mines, Ltd.	65, 200
Bentonite	130
Bergen (Grand Forks)	179
Betty (Portland Canal)	81
Beverley (Nass River)	54
Big Horn (Atlin)	300
Big Interior (Alberni)	243
Big Ledge (Arrow Lake)	235
Big Missouri (Portland Canal)	84
Bismetallic (Nelson)	218
Birch Island, station (Kamloops)	154
Bitter creek	38
Black Bear (Arrow Lake)	235
(Skeena)	47
Black Diamond (Omineca)	105
Black Hawk (Victoria)	272
Black Prince (Cayoosh)	344

	PAGE.
Black sands, Queen Charlotte islands	42
Black Wolf (Skeena)	48
Blubber bay, lime	29, 256, 258
Bluebell (Ainsworth)	209
(Nanaimo)	254
Blue Bells (Victoria)	272
Frederick arm (Nanaimo)	254
Blue Bird (Clayoquot)	246
Blue Jay (Clayoquot)	246
Blue Grouse (Slocan)	222
(Skeena)	48
Blue Mule (Queen Charlotte)	42
Blue Nose (Quesnel)	132
Blue Ribbon (Nass River)	57
Bobbie Burns basin	197
Bobbie Burns creek	195
Bolton (Skeena)	46
Bonanza (Trout Lake)	234
Bornite mountain	102
Bosun (Slocan)	227, 301
Bounty Fraction (Greenwood)	183
Braithwaite basin, plan of	158
Braithwaite creek	157
Brandon (Slocan)	223
Branham flat	142
Brenda (Fort Steele)	207
Brenton (Victoria)	275
Brenton, mount	274
Brent's claims	161
Brew (place)	268
Brewer, Wm. M., report as Resident Mining Engineer	240
Bridge river	165
Britain river	268
Britannia (Vancouver)	263
(Nass River)	57
Britannia Mining and Smelting Co.	264, 305
Flow-sheet of new mill	265
British Columbia Alluvials Co.	165
B.C. Silver Mines, Ltd.	81, 297
Broken Hill (Nelson)	217
Bruce (Vancouver)	267
Buce lake, building-stone at	170
Building-stone	9, 28, 170
Bull river, hydro-electric	301
Bulldog creek	68
Bullhead mountain	136
Bulliondale (Vancouver)	267
Bullock (Trout Lake)	233
Bunker Hill (Nass River)	56
Bureau of Mines	30
Burns lake, asphaltum near	116
Bush Mines, Ltd.	81
Butte (Trout Lake)	234
Buttle lake	254

C.

Cadwallader creek	165
Caledonia (Quatsino)	253
California (Trail Creek)	229
Cal-Roi Mining Co.	229
Cameron river (Peace River), iron on	145
Canadian (Slocan)	223
Canadian Collieries (Dunsmuir), Ltd., annual statistics	328, 331
Canadian National Railway	46
Canadian Superior Mines Co.	164
Canim lake, coal at	168
Carbon river, coal	140
CARIBOO MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Gold, free-milling	122
Lode-mining	122
Report of Resident Mining Engineer	121
Office statistics	147
Caribou creek (Arrow Lake)	234
Carnation (Slocan)	222
Carpenter creek	222
Canal Flats	199
Cascade (Omineca)	110
Cascade Bonanza (Grand Forks)	179
Cascade creek (Portland Canal)	79
Cassiar Crown Copper Co.	113
Cassidy Colliery	325
Cedar Creek camp	127
Cedar creek, Kitsumgallum lake	48
Cedar Creek Mining Co.	127, 128
Cement	9
Central (Nass River)	61
CENTRAL MINERAL SURVEY DISTRICT (No. 3):	
Report of Resident Mining Engineer	149
Centre Star (Trail Creek)	229, 300
Champness (Nanaimo)	255
Chance, Dome mountain (Omineca)	113
Chance, formerly *Last Chance* (Nass River)	59
Charleston (Ainsworth)	210
Charleston Silver Mines, Ltd.	210
Cheakamus lake	268
Chemainus river	273
Cherry creek (Vernon), gold placer	160
(Kamloops), copper	150
Chilliwack lake	260
Chilliwack river	263
Chimdemash creek	102
China creek	245
Chisholm property, Owen lake. *See* McLean property.	
Christopherson's placer	187
Chromite, *Mastodon* and Scottie creek	25
Chromium creek	259
Chu Chua	150
Chu Chua Coal Co., Ltd.,	353
Cinderella (Slocan)	222
Clay	9
Clayburn	28
Clayburn Co., Ltd.	28
CLAYOQUOT MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Magnetite	248
Report of Resident Mining Engineer	243
Office statistics	276
Clear Mountain Coal Co.	159
Clearwater river (Kamloops)	155
Map of headwaters	156
Climax (Nass River)	60
CLINTON MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Coal at Canim lake	168
Hydromagnesite	25
Sodium carbonate	25
Gypsum	169
Report of Resident Mining Engineer	168
Office statistics	173
Clothier, G. A., report as Resident Mining Engineer	34
Coal, Australian creek	126

Page.

Coal, Canim lake 168
Carbon river 140
Coalmont 191
Diamond Vale 162
Goat creek 120
Hat creek 159
Merritt 162
Mud creek 120
Normandale 162
Omineca 119
Peace river 125, 140
Princeton 190
Production 8, 9, 11
Quesnel Mining Division 125
Slatechuck creek 41
Telkwa 101
White Lake basin 185
Coal harbour 252
Coal Hill Colliery 251
Coal-mines of the Province 280
Inspection of 313
Report of Provincial Mineralogist 308
Air samples 284
Machinery 282
Coal-mine officials, examinations for 286
Coalmont, gold placer 187
Coalmont Collieries, Ltd. 191
Official returns 353
Coast collieries 27
Coast Copper Co. 251
Coke, production 8, 9, 11
Collieries of B.C., coal produced 311
Men employed 312
Coast 310
East Kootenay 310
Accidents in 377
Collison bay 44
Colossus 235
Colossus (Nanaimo) 254
See also *Lagoon*, new name.
Columbia (Golden) 197
(Portland Canal) 74
(Alberni). See *Morning*.
Combination (Greenwood) 180, 201
Plan of workings 181
Comet (Portland Canal) 76
Commodore (Nelson) 217
Comox Collieries 238

Comox lake 254
Concentrator, Golden Crest Mines 196
Condor (Golden) 196
Congress (Slocan) 238
Consolidated Homestake Mining and Development Co. 58
Consolidated Mining and Smelting Co. of Canada 240
At Rossland 259
Old Sport 251
Lucky Thought 258
Contact (Vancouver) 267
Copper 31
Copper production 8, 9, 12
(Queen Charlotte) 43
Copper Belt (Fort Steele) 246
Copper Creek (Nass River) 61
Copper Island 44
Copper King (Golden) 198
(Kamloops) 150
Near York (Omineca) 146
Copper mountain (Similkameen) 191
Copper Mountain No. 1 (Lillooet) 168
Copper No. 2 (Grand Forks) 179
Corbin Coal and Coke Co. 274
Cordula (Skeena) 45
Cork Province (Ainsworth) 211, 261
Coronation (Lillooet) 166
Copper Queen, Lakelse lake 49
(Queen Charlotte) 44
(Golden) 198
Copper River Coal Co. 120
Cottonwood canyon 124
Countess (Lillooet) 166
Cowichan lakes 272
Cracker jack (Nanaimo) 230
Crescent (Greenwood) 184
Cromwell (Trout Lake) 233, 261
Cromholm Barthelf Mines Co. 79, 82
Crown (Lillooet) 167
Crown-granted mineral claims 285
Crow's bar, Fraser river, gold placer 168
Crow's Nest Pass Coal Co., Ltd., official returns 360
Crushed rock 9, 29
Crystal (Revelstoke) 253
Cunningham creek 122

D.

Dago creek 212
Daly, Unuk river (Portland Canal) 87
Daly-Alaska, Alaska 87
Daly-Sullivan (Portland Canal) 81
Dandy (Nanaimo) 229
(Portland Canal) 74
Davis (Similkameen) 188
Davis, A. W., report as Resident Mining Engineer 149
Daybreak Mining Co. 211
Dease Creek Mines Corporation 88
Dease lake 88
Dease Syndicate 88
Defries' property (Yale) 164
Della (Clayoquot) 245
Delaire creek 88
Delta Copper Co. 101
Demaniel creek, basalte and iron 268
Derby (Nelson) 215
Devil's Canyon (Caribou) 121
Diadem, mount 268
Diadem (Omineca) 102

Diamond (Yale) 164
Diamond Belle (Omineca) 114, 116
Diamond Vale Colliery 162
Diatomaceous earth (Quesnel Mining Division) 125
Dolly Varden (New Westminster) 262
(Nass River) 60
Dome Mountain (Omineca) 109
Dome mountain 111
Dome Mountain Gold Mining Co. 112
Donkey (Greenwood) 184
Donnybrook (Nelson) 219
Donohue (Nicola) 161
Dorothea Morton (Nanaimo) 254
Dorreen (placer) 105
Dorreen creek, Kitsumgallum 48
Driftwood (Omineca) 111
Driftwood creek 111
Drum Lummon Mines, Ltd. 66, 269
Dublin Queen (Slocan) 238
Duncan Mines, Ltd. 71, 268
Plan of workings 72
Duthie Mines, Ltd. 198

E.

Eagle, Glacier creek 74
(Quesnel) 132
Eagle Talc and Mining Co. 270
Early Bird (Queen Charlotte) 42
EASTERN MINERAL SURVEY DISTRICT (No. 5):
Report of Resident Mining Engineer 194
East Kootenay coalfield 27
Report of Inspector 360
East Kootenay Power Co., Bull river 301
East Wellington Coal Co., annual statistics 329
Ecstall river 46
Edith (Portland Canal) 81
8-Mile Lake (Cariboo) 122
Eldorado Gold Mining Co., Ltd., ... 82
Electric power, Bull and Elk rivers 301
Eliza creek 49
Elk river, hydro-electric power 301
Emancipation 162
Emerald (Nelson) 219, 301
Empire, formerly *Lead King* (Omineca) 106
Engineer (Atlin) 90
Engineer No. 1 (Portland Canal) 69
Enterprise (Grand Forks) 178
Enterprise creek 229
Epsom salts (Kamloops) 171
Equinox (Greenwood) 182
Erie 219
Esperanza group, formerly *Black Bear* group (Nass River) 55
Esquimalt, lime 29
Esquimalt & Nanaimo Railway Belt 242
Eureka (Similkameen) 189
Evans' group (Fort Steele) 207
Evelyn (Omineca) 110
Evening Sun (Portland Canal) 74
Excelsior (Portland Canal) 74
Explosives in coal-mines 281
Extension Colliery 334

F.

Face-brick 9
Fairview camp 185
Falkland, gypsum 169
Falls or Hall creek 47
Federal (Osoyoos) 185
Federal Mining and Smelting Co. 104, 204
Dome mountain 112
Feo creek 168
Fern (Nelson) 217
Fiddler (Omineca) 105
Fife lime-quarry 180
Findlay creek (Similkameen), coal on 190
Finlay river, galena 99
Firebrick 9, 28
Fireclay 29
Fish Creek, Alaska 87
Fish creek, Alaska 81
Fish Creek Mining Co. 81
Fisherman cove, gold placer 260
Fleming Coal Co., Ltd. 162
Official returns 351
Florence (Ainsworth) 207, 301
Fluorite 180
Fluorspar, *Rock Candy* (Grand Forks) 25, 177
Flux 9, 52
Foggy Day (Trout Lake) 233
Foghorn (Nelson) 216
Fog Horn creek 154
Ford creek 263
Fort George (Omineca) 110
Fort George 125
Fort Graham, galena at 99
Fort St. John, dredge at 143
FORT STEELE MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Iron pyrites 25
Office statistics 236
Report of Inspector 301
Report of Resident Mining Engineer 200
49 (Portland Canal) 83
Forty-nine Mining Co. 83
Fox (Nass River) 57
Francis (Portland Canal) 74
Francois lake, asphaltum near 116
Fraser (Portland Canal) 70
Fraser river, coal 126
Gold placer 124
Frederick arm 254
Fredwells creek 158
Freeland, Philip B., report as Resident Mining Engineer 176
Frisco (Omineca) 105

G.

Gabbro (Victoria) 271
Gabbro Copper Mines 271
Galena (Portland Canal) 75
Galena at Fort Graham 99
Galena Farm (Slocan) 228
Gallant Boy (Trout Lake) 234
Gallop creek 199
Galloway, John D., report as Resident Mining Engineer 95
Gamble Mining Co. 207
Garfield (Nelson) 216
Gem (Slocan) 222
(Nanaimo) 259
George (Portland Canal) 75
Georgia River Mining Co. 67, 81
Gerald D. (Nanaimo) 259
Gething coal leases, plan of 138
Giant (Golden) 195
(Trail Creek) 229
Gibson (Ainsworth) 211
Glacier (Portland Canal) 87
Glacier creek 72
Globe, Unuk river (Portland Canal) 87
Gloria Mining Co. 68
Goat creek (Omineca), coal on 120
Goleonda (Osoyoos) 186
Gold, free (Nelson) 217
(Osoyoos) 185
(Queen Charlotte) 42
(Omineca) 113
Gold, lode, production 8, 9, 12, 22
Gold, placer, production 8, 9, 10, 12, 21, 165
(Atlin) 90
(Cariboo) 121
Cherry creek (Vernon) 160
Fisherman cove 260
Fort St. John 143
Graham island 42

PAGE.
Gold, placer, Hydraulic 90
Kitsumgallum 48
Manson creek 119
Masset inlet 41
Nahwitti river 260
North-western District 100
(Peace River) 141
Quesnel lake 127
Rembler creek 160
(Similkameen) 187
Siwash creek 162
Sutil cape 260
Tulameen 187
Watson Bar creek 168
Wildhorse creek 207
Gold Bug (Skeena) 45
Gold Cap (Skeena) 47
Gold Cliff (Portland Canal) 78
Golden Age Mining Co. 217
Golden Crown (Nelson) 215
Golden Drip (Trail Creek) 231
Golden Ears (New Westminster) 260
See also *Viking*, new name.
Golden Giant Mines, Ltd. 195
GOLDEN MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Barytes 196
Office statistics 236
Report of Resident Mining Engineer 195
Golden Nib, formerly *Iron Hat* 49
Golden Penny (Skeena) 49
Gold harbour 42
Gold Hill (Kamloops), sketch of claims 152
Description 153
Gold Hill (Nelson) 214
Gold King (Lillooet) 167
Gold river (Clayoquot) 248
Golskeish Mines, Ltd. 52
(Nass River) 298
Goodenough (Nelson) 214

PAGE.
Goodenough lake 171
Good Hope (Nanaimo) 25, 256, 258
(Nelson) 216
Goose creek 76
Graham island 41
Oil shales, black sands 42
Granby Consolidated Mining, Smelting and Power Co. 50, 298
Ecstall river 46
George 75
Sultana 107
Sunshine 74
Cassidy Colliery 325
Granby river 179
GRAND FORKS MINING DIVISION
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Fluorspar 25, 177
Lime 180
Report of Resident Mining Engineer 177
Office statistics 193
Granite, Nelson island 268
Granite creek 169
(Clayoquot) 245
Granite Poorman (Nelson) 214
Gravel 9, 29
Gray Eagle (Golden) 198
GREENWOOD MINING DIVISION
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Office statistics 193
Report of Resident Mining Engineer 180
Grey Copper (Omineca) 103
Ground Floor (Windermere) 199
Grouse mountain (Omineca) 113
Guichon creek 161
Guindon (Fort Steele) 206
Gun creek 165
Gypsum (Similkameen) 188
Gypsum, Kelly lake and Falkland 169
Tulameen river 188

H.

Hakadato (Clayoquot) 247
Hall creek (Nelson) 217
Hall or Falls creek (Skeena) 47
Hanall 102
Hardscrabble (Quesnel) 127
Hardy Bay 252
Hardy mountain (Grand Forks) 180
Harold D. (Nanaimo) 259
Hastings arm 37, 52
Hat creek, coal 159
Haystack mountain 56
Head bay, magnetite 248
Heavenly Twins No. 1 (Windermere) 199
Hedley 304
Hedley Gold Mining Co. 186
Hellroaring creek 207
Hæmatite, Hudson Hope 145
Henderson (Omineca) 108, 299
Hercules Mines, Ltd. 83
Hewitt (Slocan) 227, 301
Hidden Creek (Nass River) 298
Hidden creek (Nass River) 52
Hidden Treasure (Golden) 196
High Grade (Portland Canal) 74
Highland (Ashcroft) 159
(Kamloops) 150
Highland Mary (Golden) 197
Highland valley 150
Hiland No. 1 (Nass River) 59

Hillsbar creek, gold placer 163
Hinckley (Slocan) 222
Hollyoke creek 275
Hollywood (Portland Canal) 82
Homathko river 250
Home Guard (Nass River) 61
Homestake (Fort Steele) 207
(Nass River) 58
(Kamloops) 150, 170
(Queen Charlotte) 43
Homestake Mining and Development Co. 55
Homestake mountain 57
Hope (Slocan) 221
(Queen Charlotte) 44
Hope 162
Hopp's mines 171
Horn Silver (Omineca) 187
Horseshoe (Portland Canal) 70
(Nass River) 61
Horsethief creek 199
Hotham river 268
Houston 116
Howser lake 212
Hudson (Cariboo) 122
Hudson Bay mountain 108
Humming Bird (Nelson) 214
Hunter (Skeena) 48
Huston inlet 44

PAGE.

Hydraulic mining (Atlin) 90
Hydro-electric power, Bull and Elk rivers 301
Puntledge river 338

PAGE.

Hydromagnesite (Clinton) 25
(Kamloops) 171
Hyland Basin (Omineca) 111

I.

Idaho (Omineca) 103
(Portland Canal) 68
Idaho-Alamo (Slocan) 222
Ikeda Mines, Ltd. 44
Illiance river 61
Independence (Omineca) 105
Independence Gold Mining Co. 76
Indian Chief (Clayoquot) 244, 248
Indian Mines Corporation, Ltd. 84, 297
Plan of workings 85
Indian river 266
Inland Coal and Coke Co. 351
Invermere Mines, Ltd. 200
Inyo (Greenwood) 184
Iron (Queen Charlotte) 44
At Hudson Hope 145
Iron, Alta lake 25, 268
Iron, hæmatite (Peace River) 146
Cameron river 145
Iron, magnetite, Texada island 256
Head bay 248
Tenquille creek 168
Good Hope 25
Iron and steel industry 275
Iron Hat (Skeena) 49
Iron King (Vancouver), limonite 25, 268
Iron Mask (Kamloops) 149, 305
Iron pyrites, *Sullivan* 25
Isaac (Windermere) 200, 301
Iskut river 38, 89
Iva Fern (Nelson) 219
I.X.L. (Trail Creek) 229, 231, 300

J.

Jacko lake 150
Jackson Mines, Ltd. 226
James creek 184
James Grant (Clayoquot) 245
J. & L. (Revelstoke) 195
Jedway 44
Jenny Jiggs (Skeena) 49
Jefferson Syndicate 112
Jeffries (Greenwood) 183
Jervis inlet 268
Jordan river 271
Jubilee (Nelson) 217
Juditta (Grand Forks) 180
Jumbo (Grand Forks) 180
Jump creek 260
June Landing 252
Juneau (Nanaimo) 256

K.

Kamloops Mines Co., Ltd. 255
KAMLOOPS MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Report of Inspector 305
Report of Resident Mining Engineer 149
Office statistics 175
Magnesium sulphate 171
Sodium sulphate 170
Hydromagnesite 171
Barytes 170
Silica flux from 172
Building-stone 170
Kane creek 223
Kathleen (Kamloops) 150
(Ashcroft) 159
Keithley creek 132
Kelly lake, gypsum 169
Kennedy lake (Clayoquot) 245
Kennedy river 244
Keystone (Ainsworth) 211
Keystone Coal Co. 162
Keystone Mining Co. 54
Kildare mines (Omineca) 119
Killarney (Greenwood) 182
Kim (Nanaimo) 256
Kimberley 200
King and Foster Colliery 328
King Solomon (Victoria) 272
Kirby (Ainsworth) 209
Kirk lake 256
Kitchener (Portland Canal) 86
Hydraulic 132
Kitsalas Mountain Copper Co. 101, 104
Kitsault river 54
Map of 62
Kitsumgallum lake, map 63
Kitsumgallum river 46
Kleanza Co. 102
Kleanza creek 102
Klinaklini river 259
Knob Hill (Similkameen) 192
Koksilah lake 272
Kootenay District, North-east 235
Kootenay Belle (Nelson) 218, 301
Kootenay lake, lime-quarry 25
Kootenay Star (Slocan) 226
Krao (Ainsworth) 209

L.

Labor Day Frac. (Slocan) 226
Lachland Grant (Clayoquot) 245
Ladner creek 162
La Fontaine (Cariboo) 122
La France creek, lime from 25
Lagoon, formerly *Colossus* (Nanaimo) 254, 255
Lakelse (Skeena) 49
Lakelse valley 49
Lakeshore (Ainsworth) 208
Lakeshore Mining Co. 208
Lakeside (Ainsworth) 213
Lakeview (Portland Canal) 74
(Omineca) 113
Lanark (Revelstoke) 233
L. & L. (Portland Canal) 73
Langley, A. G., report as Resident Mining Engineer 194

	Page
LARDEAU MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Office statistics	237
Report of Resident Mining Engineer	232, 235
Lasqueti island	256
Last Chance (Nass River)	59
See also *Chance*.	
Last Chance (Slocan)	224
(Kamloops)	155
Last Chance lake	171
L. Grant (Clayoquot)	245
Lead, production	8, 9, 12, 23
Lead King, restaked as *Empire* (Omineca)	103
Leadville (Nelson)	220
Leadville Mining Co.	220
Leah (Grand Forks)	170
Legate creek	103, 105
Lenora (Victoria)	273
Le Roi (Trail Creek)	229, 300
Le Roi No. 2 (Trail Creek)	229, 300
Leslie (Portland Canal)	81
LIARD MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Report of Resident Mining Engineer	87
Office statistics	92
Lightning creek	123
Lightning Creek Gold Gravels and Drainage Co., Ltd.	122
Lightning peak	182
Lignite, Hat creek	159
(New Westminster)	29
Lil-i-kel (Lillooet)	167
Lillie-Grouse (Vancouver)	268
LILLOOET MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Office statistics	153
Report of Resident Mining Engineer	165
Lillooet Soda Co., Ltd.	25, 171
Lime	9
Shoaler Bay	29
Rubber bay	29
Esquimalt	29
Fife	181
Marble bay	29
Saanich	29
Texada	29
Lime carbonate	25
La Fontaine creek, Kootenay lake	25
Lime creek (Nass River)	49, 54
Limonite, Victoria Mining Division	268
Snake	268
Alta lake	268
Hudson Hope	145
Limestone	9
Sturt bay	256, 258
Texada island	256, 258
Little Beaver river	49
Little Joe (Omineca)	111
Lois (Portland Canal)	81
Lone Maid (Nass River)	56
Lone Star (Nass River)	61
Lookout (Omineca)	186
Lorne (Lillooet)	165
Lost creek (Greenwood)	182
(Nelson)	219
Louis creek	170
Louise (Cariboo)	121
L. T. (Slocan City)	229
Lucky Four (New Westminster)	260, 263
Lucky Jim (Slocan)	223
(Omineca)	103
Lucky Luke (Omineca)	104
Lucky Strike (Nass River)	57
Lucky Thought (Slocan)	228
Lucy O'Neil (Skeena)	48
Lydia (Kamloops)	154
Lynx (Nass River)	54
(Nanaimo)	254

M.

McAllister (Slocan)	223, 301
McDame creek	88
McDonald creek (Windermere)	190
McGuigan creek	224
McKee creek	90
McLean property, Owen Lake	116
McRae creek	177
Maestro (Ainsworth)	200
Magpie (Clayoquot)	244
Magnesite (Kamloops)	171
Magnesium sulphate (Kamloops)	171
Magnetite, Texada Island	256
Good Hope	25, 258
Head bay	248
(Queen Charlotte)	12, 44
Mahood (Portland Canal)	81
Maid of Erin (Atlin)	101
Mamie (Omineca)	108
Mammoth (Yale)	164
(Slocan)	227
Mamquam river	268
M. & K. (Omineca)	105
Manganese	25
Manson	110
Manson creek	100
Mantle (Nelson)	215
Maple bay (Portland Canal)	67
Marble Bay (Nanaimo)	253
Marble bay Lime	29
Margaret (Victoria)	271
Marie (Clayoquot)	244
Marjory (Golden)	186
Mark creek	204
Marks' placer	187
Marmot river	68
Marson creek	48
Marten (Skeena)	49
Martin (Ainsworth)	202
Mary Florence (Skeena)	258
Mascot (Slocan)	227
Masseno	100
Masset inlet, gold placer	43
Matchless (Grand Forks)	172
Matilda (Nass River)	57
Mayblossom (Nelson)	211
Mayflower (Portland Canal)	74
M. C. (Portland Canal)	78
Meal Ticket (Queen Charlotte)	41
Men employed	19
Merlin (Greenwood)	180
Metalliferous mines, inspection of	27
Metallic (Slocan)	228
Meteor (Slocan City)	229
Methodist lake	87
Mica, Tete Jaune	99
Middlesboro Collieries, Ltd.	162

PAGE.

Middlesboro Collieries, Ltd., official returns.... 346
Midnight (Slocan) 228
Millbank (Skeena) 46
Millie Mack (Arrow Lake) 234
Millington (Quatsino) 251
Mimico (Portland Canal) 73
Mineral Basin (Portland Canal) 87
Mineral Hill (Portland Canal) 83
Mines, Inspector of, report of 279
Mines shipping in 1923 383
Mines Department, personnel of staff 389
Minnesota Girl (Kamloops) 155
Mobile Mines, Ltd. 71
Moffatt (Lillooet) 167
Molly Gibson (Burnt Basin) Mining Co. 177
Molly Gibson (Nelson) 214
Molly Hughes (Slocan) 227, 301
Molybdenite 25
(Grand Forks) 179
Monarch (Nass River) 61
(Slocan) 227
Monashee creek 160
Monitor (Slocan) 222
Montana (Portland Canal) 83
Monte Carlo (Kamloops) 150
Moose No. 1 (Nass River) 59
Morelli (Grand Forks) 180
Moresby island 42
Morning (Alberni) 242
Morning Star (Osoyoos) 185
(Portland Canal) 75
Morore (Nanaimo) 256
Mosquito Creek (Cariboo) 121
Motherlode (Skeena) 48
Mountain Chief (Slocan) 227
Mountain View (Osoyoos) 186
Muchalat arm 248
Mud creek (Omineca), coal on 120
Multiplex (Trout Lake) 233
Murdock (Portland Canal) 75
Murray-McGregor Co. 127
Musketeer (Nass River) 60
Myra creek 254
Mystery (Fort Steele) 207

N.

Nabob No. 3 (Portland Canal) 75
Nahwitti river, gold placer 260
NANAIMO MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Office statistics 277
Report of Resident Mining Engineer 252
Limestone 29, 256, 258
Magnetite 256
Nanaimo river 260
Nancy (Similkameen), gypsum 188
Nancy Bell (Nanaimo) 256, 257
Nanoose-Wellington Collieries Co., Ltd., annual statistics 323
Naomi (Kamloops) 155
Napanee (Greenwood) 183
Nasakwatch river 260, 263
NASS RIVER MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Office statistics 93
Report of Resident Mining Engineer 49
Report of Inspector 298
Nass river, map of part of 62
Nass River Lands, Ltd. 71
Nation lake 100
Neepawa (Slocan City) 229
Nelson island, granite 268
NELSON MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23, 221
Lime 25
Office statistics 239
Report of Resident Mining Engineer 214
Report of Inspector 301
Nettie M. (Windermere) 199
New Denver 227
New Find (Skeena) 49
New Jack of Spades (Grand Forks) 180
New Waverley Hydraulic Mining Co. 121
NEW WESTMINSTER MINING DIVISION:
Office statistics 278
Report of Resident Mining Engineer 260
Nickel (Yale) 165
Nickel Plate (Osoyoos) 186, 304
Arsenic at 25
NICOLA MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Report of Inspector 304, 345
Report of Resident Mining Engineer 161
Nigger Baby (Nanaimo) 257
Nimrod Mining and Development Co. 254
Nine-mile Mountain (Omineca) 106
Nip and Tuck (Fort Steele) 301
Noble Five (Trout Lake) 301
Nodaway (Greenwood) 184
Nome (Nass River) 58
No Name No. 1 (Nass River) 58
Nootka sound 247
Normandale Colliery 162
North (Portland Canal) 74
North Country Mining Co. 68
NORTH-EASTERN MINERAL SURVEY DISTRICT (No. 2):
Report of Resident Mining Engineer 95
Northern Belle (Slocan) 226
North Fork Basin (Portland Canal) 70
North Star (Fort Steele) 204
(Slocan) 228
North Thompson river 151
NORTH-WESTERN MINERAL SURVEY DISTRICT (No. 1):
Report of Resident Mining Engineer 34
Nugget (Nelson) 301
(Golden) 197
Nugget Gold Mines 218

O.

Oakla (Omineca) 118
Oakwood (Skeena) 49
Observatory inlet 50
Octagon (Vernon) 161
Ohio (Nanaimo) 255
(Greenwood) 183
Ohm (Nanaimo) 256
Oil, Graham island 42
O.K. (Trail creek) 231, 300
Okanagan lake 159
Olalla 186
Old Sport (Quatsino) 251

PAGE.
Old Victoria (Nanaimo) 256
Old Woman (Nass River) 61
OMINECA MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Office statistics 147
Coal 119
Gold, placer 100
Report of Inspector 299
Report of Resident Mining Engineer 101
One Eye lake 259
O'Neill river 52
Ophir (Slocan) 226
Oro Fino (Omiyoos) 186
OSOYOOS MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Arsenic 25
Office statistics 197
Report of Resident Mining Engineer 185
Ottawa (Slocan City) 229
Outsider (Nass River) 65
Plan of workings 66
(Portland Canal) 298
Owen lake 133

P.

Pacific Coast Steel Co. 258
Pacific Great Eastern Railway 267
Pacific Lime Co. 256, 258
Pacific Steel Co. 252
Paper-mills, lime for 29
Paradise (Windermere) 199, 301, 302
Paramount Mining Co. 254
Park (Fort Steele) 207, 301
Patricia (Portland Canal) 69
Patterson group (Skeena) 46
Payne (Slocan) 225
Pay Roll (Portland Canal) 87
Paulson 177
Pauper (Victoria) 274
Paw (Nanaimo) 254
P.B.C. Co. 119
Peace River coalfield 344
Peace River Gold Dredging Co. 142
Peace River Mining and Milling Co. 144
PEACE RIVER MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Gold, placer 141
Coal 136
Report of Resident Mining Engineer 132
Peggy (Osoyoos) 187
Pegleg (Slocan City) 229
Pemberton meadow (Clinton) 166, 169
Pendleton Mining Co. 88
Perkins gulch 122
Perry creek 207
Phebe Daniels (Nass River) 54
Phillips arm 254
Phoenix (Windermere) 199
Pierce mountain 263
Pilot Fraction (Nelson) 216
Pingston creek 235
Pioneer (Lillooet) 166
Pitt island 45
Pitt lake 260
Pitt Mining Co. 260
Plan of property 261
Pittsmont (Portland Canal) 87
Placer Gold Mines Co. 90
Platinum 25
Tulameen river 187
Platinum, Queen Charlotte 45
Mission creek 161
Vernon 161
New Jack of Spades 180
Plattenberger (Skeena) 46
Platt lease (Quesnel) 131
Point (Cariboo) 122
Poplar (place) 232
Porcher island 46
Porcupine creek (Vernon) gold placer 160
Porcupine creek (Nelson) 217
Port Essington 46
Portland (Skeena) 48
PORTLAND CANAL MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Office statistics 94
Report of Inspector 297
Report of Resident Mining Engineer 64
Portland Canal Mining Co. 71
Portland Mining Co. 48
Pottery 9
Powell River Pulp and Paper Co. 256
Premier Extension Gold Mining Co., Ltd. 86
Premier (Portland Canal) 22, 79, 297
Premier Gold Mining Co., Ltd. 79
Preston (Greenwood) 184
Price creek 254
Prices of metals, charts 15, 16, 17
Prince John (Portland Canal) 298
Prince John Mining Co. 76
Plan of workings 77
Princeton Coal and Land Co., Ltd. 190
Official returns 297
Princeton Mining and Development Co. 189
Production tables 7, 8, 14
Progress of mining 11
Prosecutions, "Coal-mines Regulation Act" 281
Proserpine mountain 122
Province (Clinton) 169
Ptarmigan 244
(Skeena) 49
(Windermere) 200
Ptarmigan Mines, Ltd. (Clayoquot) 244
Pugsley (Skeena) 45, 200
Python (Kamloops) 150

Q.

Quartz creek, Peace river 144
Quatse lake 252
QUATSINO MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Office statistics 276
Report of Resident Mining Engineer 251
Queen (Nass River) 59
(Nelson) 218, 302
Queen Bess (Slocan) 222
Queen Charlotte Island General Development Co. 43
QUEEN CHARLOTTE MINING DIVISION:
Mineral production 8, 9, 12

PAGE.

QUEEN CHARLOTTE MINING DIVISION—*Continued.*
Shipping mines 19, 22, 23
Coal 41
Magnetite 42
Report of Inspector 300
Report of Resident Mining Engineer 41
Office statistics 94
Quesnel lake 127

PAGE.

QUESNEL MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Diatomaceous earth 125
Coal 125
Quartz claims 131
Office statistics 148
Report of Resident Mining Engineer 125

R.

Radiant (Vancouver) 267
Railway Mine group (Fort Steele) 206
Rainbow (Cariboo) 122
Rainy Hollow 90
Rambler (Greenwood) 183
(Nass River) 298
Rambler-Cariboo (Slocan) 223
Raush river 159
Raven bay 258
Ray creek 267
Reco (Slocan) 222
Red Bluff (Portland Canal) 298
Red brick 9, 28
Red Cliff (Victoria) 273
Red Elephant (Ainsworth) 213
Red Jacket (Victoria) 273
Red mountain 229, 268
Red Rose (Omineca), tungsten at 106
Red Star (Similkameen) 192
Red Top (Kamloops) 153
At Vavenby 155
(Portland Canal) 75
R. E. Lee (Slocan) 224
Relief (Skeena) 48
Relief No. 1 (Windermere) 200
Rembler creek 160
Reno (Nelson), plan of workings 218
Description 219
Retriever (Nanaimo) 257
REVELSTOKE MINING DIVISION:
Mineral production 8, 9, 12

REVELSTOKE MINING DIVISION—*Continued.*
Shipping mines 19, 22, 23
Report of Resident Mining Engineer 232
Office statistics 237
Revenge (Greenwood) 183
Richmond (Grand Forks) 180
Rider (Golden) 197
Riondel 209
Rio Tinto (Nanaimo) 255
(Nelson) 220
Riprap 9
Riverdale, Alaska 87
Rob Roy (Greenwood) 182
Robert E. Burns (Golden) 197
Robson (Grand Forks) 180
Roche river 192
Rocher Déboulé mountain 106
Rock Candy (Grand Forks) 25, 180
Fluorspar 177
Rocky Mountain canyon 136
Roundy creek 49, 54
Rose, formerly *Rose Marie* 244
Rose Marie (Clayoquot) 244
Rossland 229, 301
Ruby creek (Atlin) 90
Rufus (Portland Canal) 76
Ruth (Portland Canal) 74
(Slocan) 221
Ruth-Hope (Slocan) 301
Ruth-Hope Mining Co. 221

S.

Saanich inlet, lime 29
Sadie (Clayoquot) 244
Safety-lamps 282
Sally (Greenwood) 183, 301
Salmon-Bear River Co. 79
Salmon river (Portland Canal) 78
Saloomt (Bella Coola) 44
Sand 9
Sandon 221
Sandy (Trout Lake) 234
Seattle (Grand Forks) 179
Second Relief (Nelson) 219
Selukwe Gold Mining and Finance Co., Ltd. 81
Selwyn mountain 143
Seymour arm 150
Scenic (Skeena) 48
Scottie creek, chromite 25
Shawnigan lakes 272
Sheba No. 1 (Nelson) 217
Shepherd Mining Co. 209
Sherbrook (Nelson) 220
Shipping mines 19
Shuswap lake 150, 172
Shuttle island 43
Sibola mountain 119
Sicker, mount 274
Sidney inlet 248
Silica (Kamloops) 172
Silver, production 8, 9, 12, 22
Silverado (Portland Canal) 70
Silver Band (Nass River) 61
Silver Bar Mining and Development Co., Ltd. 61
Silver Basin (Omineca) 103
Silver basin (Omineca) 102
Silver Bear (Ainsworth) 211, 301
Silver Bell (Nass River) 61
(Lillooet) 167
(Ainsworth) 301
Silver Chief (Similkameen) 188
Silver Chief Mining Co. 262
Silver creek (New Westminster) 263
Silver Crown (Osoyoos) 185
Silver Daisy (Yale) 163
Silver Dollar (Skeena) 49
Silver Hill (Portland Canal) 83
Silver Hoard (Ainsworth) 208
Silver Hoard Mines, Ltd. 208
Silver Horde (Nass River) 60
(Omineca) 103
Silver King, Driftwood creek (Omineca) 111
Silver Leaf (Nanaimo) 260
Silver Minnow (Kamloops) 150

Page

Silver Queen (Omineca) 114
Plan of claims 115
Silversmith (Slocan) 221
Silversmith Mines, Ltd. 221, 301
Silver Standard (Omineca) 105, 250
Silver Star (Nass River) 61
Silver Tip, Sibola mountain (Omineca) 119
(Portland Canal) 83
Silverton 227
Sir Wilfred (Trout Lake) 254
Siwash creek (Vernon) 161
(Yale), gold placer 163
6-Mile creek, Fraser river 125
SIMILKAMEEN MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Platinum 25, 187
Coal 190
Bentonite 190
Report of Inspector 360
Office statistics 186
Report of Resident Mining Engineer 187
Reference 345
Skagit river 163
SKEENA MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Gold, placer 48
Report of Resident Mining Engineer 45
Office statistics 93
Report of Inspector 260
Skeena river 101
Slade creek 200
Slatechuck creek, coal 41
Slesse creek 263
Slocan Boy (Slocan) 225
SLOCAN CITY MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23, 220
Report of Resident Mining Engineer 220
Office statistics 228
SLOCAN MINING DIVISION:
Mineral production 8, 9, 12
Shipping mines 19, 22, 23, 228
Report of Resident Mining Engineer 221
Office statistics 238
Slocan Star (Slocan) 221, 301
Slough creek 122
Snowstorm (Ashcroft) 150
(Kamloops) 150
Snowshoe (Cariboo) 125
Society Girl (Skeena) 49
Soda-ash (Clinton) 172
Sodium carbonate 25, 171
Sodium sulphate, Kamloops lake 170
Soho (Slocan) 225
Sooke, bauxite and iron 208
Sooke river, talc 25
South (Portland Canal) 74
South Exeter (Queen Charlotte) 42
SOUTHERN MINERAL SURVEY DISTRICT (No. 4):
Report of Resident Mining Engineer 176

Page

Sovereign (Slocan) 225
Sowaqua creek 162
Spanish creek, hydraulic 127
Spartan Oil Co. 204
Spider (Portland Canal) 81
Spokane (Nelson) 219
Spokane Trinket (Atlin) 240
Spotted Horse (Greenwood) 182, 202
Springer creek 229
Spring Creek (Atlin) 240
Stampmill, Ore Dan 180
Standard (Nass River) 61
(Slocan) 227, 301
Standard Fraction (Greenwood) 181
Standard Silver Lead Mining Co. 227
Star (Yale) 166
Star of the West (Fairview) 247
Steele (Windermere) 200, 201
Stemwinder (Osoyoos) 185
(Fort Steele) 200
St. Eugene (Fort Steele) 201
Steve Vernon (Trout Lake) 254
Stewart Mining and Development Co. 77
St. Paul (Vernon) 160
Stibnite (Nanaimo) 254
STIKINE MINING DIVISION
Mineral production 8, 9, 12
Shipping mines 19, 22, 23
Report of Resident Mining Engineer 87
Office statistics 92
Stikine river 88
Stony creek, bauxite and iron ore 208
Strathcona Park, prospecting in 254
Sturt bay, limestone 250, 258
Sullivan (Fort Steele) iron pyrites 25
References 201, 202
Primary crusher 202
Concentrator 201
Sulphurite creek 87
Sultana (Omineca) 107
Sumallo creek 163
Summit (Kamloops) 157
(Nass River) 56
Summit camp, Tulameen river 188
Sunbeam (Nanaimo) 254
Sunlight (Skeena) 48
Sunlock (Victoria) 271
Sunnyside (Greenwood) 182
Sunrise (Portland Canal) 83
(Omineca) 104
Sunrise Mining Co. 106
Sunset (Portland Canal) 82
(Nass River) 56
Sunshine (Vancouver) 269
(Portland Canal) 74
Surprise (Skeena) 49
(Slocan) 222
Surprise No. 2 (Ashcroft) 153
Susie (Osoyoos) 185
Sutil, cape, gold placer 203
Swamp river 122
Swanson bay 66
Swede (Quesnel) 4

T.

Page

Tacoma Steel Co. 256
Taft (Nelson) 219
Tahsis (Clayoquot) 247
Tahsis canal 244
Taku river 38, 80
Talc, Sooke river 25, 270
Talkeetzkwa river, *see* Tulameen
Tamihi creek 262
Tasekia river 188, 250
Tatlayoko (Nanaimo) 260
Tatlayoko Lake Gold Mining Co. 250
Taylor river 242, 244, 245

	PAGE.
Teddy Fraction (Nelson)	216
Telkwa, coal	101
Telkwa Collieries Co.	98, 343
Telkwa section	107
Tenquille creek	166
Terrace	46
Tertiary (Cariboo)	124
Tesla mountain	44
Tete Jaune	99
Texada island, lime	29, 256, 258
Iron, magnetite	256
Theda Bara (Nass River)	54
Thibert creek	88
Thompson, North, river (Kamloops)	155
Map of headwaters	156
Thornhill mountain	49
Three Forks	222
Thunder (Queen Charlotte)	44
Tidewater Copper Co.	244, 248, 306
Plan of workings	249
Tiger (Nass River)	60
Tipperary (Osoyoos)	187
Titan, Alaska	87
Toby creek	199
Tofino	246
Tom Moore (Slocan)	225
Torie (Nass River)	60
TRAIL CREEK MINING DIVISION:	
Report of Resident Mining Engineer	229
Report of Inspector	300
Office statistics	239
Trail smelter	229
Fluorspar, use of	25
Tributary creek	227
Trillion (Nelson)	219
TROUT LAKE MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Report of Inspector	301
Report of Resident Mining Engineer	232, 233
Office statistics	238
True Fissure (Trout Lake)	233, 301
Tulameen river	187
Platinum	187
Gypsum	188
Tulsequeh Chief (Stikine)	89
Tulsequeh river	89
Tungsten, *Red Rose* (Omineca)	106
Twenty-three-mile camp	163
Tyee (Portland Canal)	74
(Victoria)	273
Tzoonie river	268

U.

Unicorn (Portland Canal)	83
United (Ainsworth)	209
United Metals (Nass River)	61
United Mines, Ltd.	209
Unuk River section, report of Resident Mining Engineer	87
Unuk river	37
U.S. (Greenwood)	184
Usk	101
Usk (Omineca)	102
Utica (Ainsworth)	210

V.

Valhalla (Omineca)	102
Vancouver (Portland Canal)	86
Vancouver Granite Co.	268
VANCOUVER MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Iron, limonite	268
Report of Resident Mining Engineer	263
Office statistics	277
Vanguard (Nass River)	57
Van Roi (Slocan)	227, 301
Vavenby	155
Venus (Nanaimo)	256
VERNON MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Platinum	161
Office statistics	174
Report of Resident Mining Engineer	159
Verona (Nass River)	54
Vetron (Portland Canal)	76
Victor (Slocan)	223
Victoria (Slocan)	222
VICTORIA MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Talc	25, 270
Lime	29
Gravel and rock	29
Bauxite	268
Office statistics	277
Report of Resident Mining Engineer	268
Victory (Omineca)	109
Viking, formerly *Golden Ears* (New Westminster)	260
Viking Mining Co.	260
Vimy Ridge (Nass River)	54
(Nicola)	161
Virginia (Alaska)	87
Vital creek	119

W.

Wakefield (Slocan)	228
Wallace mountain	183
Wallace Mountain Mines, Ltd.	183
Wanderer (Clayoquot)	245
War Colt (Kamloops)	157
War Eagle (Trail Creek)	229, 300
Warner pass	168
Washington (Slocan)	225
Washington group (Portland Canal)	69
Washington Mines, Ltd.	225
Water Power (Victoria)	275
Watson Bar creek, gold placer	168
Waverley (Cariboo)	121
Wayside (Lillooet)	165
Wesa (Greenwood)	182
Western Fuel Corporation of Canada, Ltd., annual statistics	314
WESTERN MINERAL SURVEY DISTRICT (No. 6):	
Report of Resident Mining Engineer	240
West Fork (Greenwood)	182
Westkettle river	183
Whale (Victoria)	274, 275

	Page
Whirlwind **(Osoyoos)**	187
White Bear **(Trout Creek)**	300
White Cat **(Windermere)**	199
White Elephant **(Vernon)**	159
Whitefish creek	207
White Lake basin (Osoyoos), coal	186
Whitewater Deep **(Ainsworth)**	210
Whitewater Gold Fields, Ltd.	168
Whitewater Mines, Ltd.	210
Whynot **(Similkameen)**	189
Wigwam **(Revelstoke)**	232
Wilcox **(Nelson)**	216
Wildhorse creek (Nelson)	215
Gold placer	207
Wild Horse Gold Mining Co.	207
Williams creek (Skeena)	49
Willow Grouse **(Victoria)**	271
WINDERMERE MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Report of Resident Mining Engineer	199
Office statistics	200
Windfall (Clinton)	168
Windpass (Kamloops)	149, 151
Wingdam Company, Ltd.	122
Win the War (Greenwood)	184
Wolf lake (Similkameen)	188
Wolverine (Clayoquot)	247
Wonder (Quesnel)	151
Wonderful (Revelstoke)	232
(Slocan)	221, 301
Woodbine (Portland Canal)	80
Worsoe electric furnace	275
Wright Syndicate	127

X.

X-Ray **(Nanaimo)**	257

Y.

YALE MINING DIVISION:	
Mineral production	8, 9, 12
Shipping mines	19, 22, 23
Nickel	165
Arsenic	165
Report of Resident Mining Engineer	162
Office statistics	174
Yankee Girl	214
Yellowstone (Portland Canal)	82
Yellowstone Mining Co.	218
Ymir	214
You (Clayoquot)	244
Yukon (Nass River)	58

Z.

Zeballos river	246
Zymoetz river, coal on	120
Zinc	23
Production	8, 9, 12

LIST OF ILLUSTRATIONS, 1923.

PLANS.

	Page.
Alice L.—Section of Workings	178
Braithwaite Basin	158
Britannia—Flow-sheet of New Mill	266
Clearwater and North Thompson Rivers—Map	156
Combination—Mine-workings	181
Dunwell—Mine-workings	72
Gething Coal Leases—Map	126
Granby Company, Anyox—Flow-sheet of Concentrator	53
Indian Mines Corporation—Plan of Workings	85
Kitsault River to Nass River—Map	62
Lava Lake to Skeena River	63
Lydia—Mine-workings	154
Outsider—Mine-workings	66
Owen Lake—Plan of Claims at	115
Pitt Lake Mining Company—Plan of Property	261
Prince John—Mine-workings	77
Reno—Plan of Workings	218
Silver Queen—Plan of Claims	115
Sullivan Mine—Flow-sheet of New Mill	291
Tidewater Copper Company—Plan of Workings	240
Windpass, Red Top, etc.—Claims	152
Windpass—Workings	151

PHOTOGRAPHS

	Facing page.
Allenby Copper Company—Concentrator at Allenby	192
Atlin—Hydromagnesite Deposit at	88
Braithwaite Basin, Clearwater River	159
Bull River Hydro-electric Plant	208
Cassidy Colliery—Office Building	220
Cassidy Colliery—Men's Quarters	220
Clinton—Magnesite Deposit	144
Clinton—Sodium Carbonate	144
Douglas' Letter of Instruction to McKay re Opening of Nanaimo Coalfield	312
First-aid Coulson Cup Winners in 1923	296
Francois Lake, Omineca	104
Fourth of July Creek, Atlin	88
Gething Creek Coal-deposits, Peace River	129
Goodenough Lake—Sodium Carbonate Deposit	168
Granby Consolidated Mining, Smelting and Power Co.—Anyox Mine Camp	48
Granby Consolidated Mining, Smelting, and Power Co.—Copper at Dock	48
Henderson Mine, Omineca	104
Hobson Lake, Kamloops Mining Division	136
Illiance-Tchitin Rivers Divide	90
Kitsault River	56
Last Chance—Sodium Carbonate Deposit	168
Marks' Placer-workings, Similkameen	176
Middlesboro Colliery, Nicola Mining Division	Frontispiece
Mine-rescue, Department of Mines Shield Winners, 1923	296
Nickel Plate Mine—Mill at Hedley	184
Peace River Coalfield—Shipping Coal down Peace River	128
Peace River Gold Dredging Company—	
Transporting Supplies	112
Plant at Branham Flat	112
Peace River Mining and Milling Co.—	
Milling Plant	120
Chute to the Mine	120
Prospector's Arrastra, Osoyoos Mining Division	184
Rossland and Trail—Panorama of Country	224
Salmon River Valley—Panorama of	40
Skagit River	182
St. Paul Mine, Vernon Mining Division	152
Sullivan Concentrator, Kimberley	290
Sullivan Crushing Plant	208
Windfall Mine, Clinton Mining Division	160
Windpass Mine, Kamloops Mining Division	152

VICTORIA, B.C.:
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